Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

A 280.39
M34Amw
Cop. 3

LIBRARY
NOV 21 1956

Strengthening MARKETING SERVICE Programs by Use of Research Findings

A Report of the
National Marketing Service
Workshop
at West Lafayette, Ind.
November 15-17, 1955

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service *in cooperation with*
STATE DEPARTMENTS OF AGRICULTURE

Washington, D. C. June 1956

AMS-116

PREFACE

The 1955 National Marketing Service Workshop was held at Purdue University, West Lafayette, Ind., November 15 to 17. It was attended by 140 marketing specialists, representing 30 States and the U. S. Department of Agriculture.

The central theme of the workshop was "Strengthening Marketing Service Programs through Use of Recent Research Findings." Thirty-one speeches, presenting recent research findings, were given, which may be grouped under the following four main topics: (1) Maintaining the quality of farm and food products as they move through the marketing channel, (2) reducing the cost of marketing these products, (3) expanding the outlets for farm products, and (4) improving market information.

The program for the workshop was developed by the following committee:

George H. Chick, Chief, Division of Markets, Maine Department of Agriculture, Augusta, Maine.

John A. Winfield, Director, Division of Markets, North Carolina Department of Agriculture, Raleigh, North Carolina.

W. L. Witte, retired, former Chief, Markets Division, Wisconsin Department of Agriculture, Madison, Wisconsin.

Barnard Joy, Assistant to the Administrator, Agricultural Research Service, U.S.D.A., Washington, D. C.

William C. Crow, Liaison Officer, State Departments of Agriculture, A.M.S., U.S.D.A., Washington, D. C.

L. G. Foster, Liaison Office, State Departments of Agriculture, A.M.S., U.S.D.A., Washington, D. C.

George Goldsborough, Liaison Office, State Departments of Agriculture, A.M.S., U.S.D.A., Washington, D. C.

Edward C. Collins, Liaison Office, State Departments of Agriculture, A.M.S., U.S.D.A., Washington, D. C.

This report presents the speeches that were given at the workshop, as well as the conclusions reached by 19 work groups as to the best action for marketing service people to take in dealing with specific problems. It is hoped that the report will help marketing service people to assist producers and marketing firms and agencies in applying these findings and adopting improved marketing practices.

During the workshop, the Advisory Committee on Cooperative Work under the Agricultural Marketing Act with State Departments of Agriculture held a meeting on November 16 and 17. At this meeting the Committee decided that another

workshop should be held in 1956, and urged that the marketing service programs throughout the States emphasize work in the following fields:

1. Reducing costs of marketing and promotion of efficiency.

2. Expanding market outlets.

3. Maintaining the quality of products as they move through the system.

4. Collecting and disseminating statistical data and other information needed for the improvement of the marketing of agricultural products.

5. Coordination of service projects with the available research findings and the educational program conducted by the Agricultural Extension Service.

CONTENTS

	Page
Program	1
Plans for the workshop - William C. Crow	8
The role of marketing services in improving the marketing of farm products - D. N. McDowell	9
Maintaining the quality of dairy products	12
Speech by F. E. Fenton	12
Recommendations of work group	36
Maintaining the quality of grain and oilseeds	36
Research to maintain grain quality - Speech by William C. Dachtler	36
Recommendations of work group	44
Reducing deterioration and spoilage of fruits and vegetables in marketing channels	46
Speech by Harold T. Cook	46
Recommendations of work group	48
Maintaining the quality of poultry and eggs	49
Speech by Lyle L. Davis	49
Recommendations of work group	55
Quality maintenance and grading of livestock	56
How to market hogs today - Speech by George F. Henning	56
Current research on consumer preferences for meat quality - Speech by Harold M. Riley	59
Recommendations of work group	59

Page

Does distribution cost too much? - Omer W. Herrmann 65

How research results can be used to reduce marketing costs -
Max E. Brunk. 70

Increasing sales of dairy products. 78
Speech by Shelby A. Robert, Jr. 78
Recommendations of work group 83

Reducing costs of handling grain. 85
Speech by William C. Dachtler 85
Speech by John C. Winter. 88
Recommendations of work group 92

Improving containers and methods of packaging fruits and vegetables . . 93
Speech by Donald R. Stokes. 93
Recommendations of work group 100

Reducing costs of marketing poultry and eggs. 101
Speech by John J. Scanlan 101
Recommendations of work group 109

Country livestock auctions. 110
Speech by Cortes G. Randell 110
Recommendations of work group 119

Reducing costs of handling milk 120
Speech by Charles E. French 120
Recommendations of work group 126

Grading grain and oilseeds. 126
Grain and oilseed standardization investigations - Speech by
Lawrence Zeleny. 126
Recommendations of work group 134

Reducing costs of handling fruits and vegetables. 135
Speech by Joseph F. Herrick, Jr. 135
Recommendations of work group 142

Expanding sales of poultry and eggs 143
Speech by James M. Gwin 143
Recommendations of work group 144

Improving the handling and increasing the demand for meat 145
Speech by D. E. Brady 145
Recommendations of work group 148

Expansion of market outlets 149
The role of the Extension Service in expanding markets for
agricultural products - Raymond C. Scott 149
The role of State Departments of Agriculture in expanding outlets by
putting into practice the results of research. 154

Page

Research work done by the Maine Agricultural Experiment Station on consumer preference for potatoes - Alvah L. Perry 154
How the Maine Department of Agriculture puts into practice the results of potato research - George H. Chick. 156
The role of the Food Distribution Division, A.M.S., U.S.D.A., in expanding outlets: How the Plentiful Foods Program works to expand markets - G. Chester Freeman. 160

Organizing the resources of public agencies and industries to move commodities in plentiful supply 165
Speech by Raymond B. Wilson. 165
Recommendations of work group. 169

Improved dissemination of market information - Recommendations of work group. 171

Improving the transportation of farm products. 172
Speech by John C. Winter 172
Recommendations of work group. 178

Improving wholesaling and retailing. 179
Speech by Raymond W. Hoecker 179
Recommendations of work group. 184

Concluding remarks - William C. Crow 185

Persons attending the workshop 186

NOTE: The following speeches were not transmitted for inclusion in this report:

1. "Quality Maintenance and Grading of Livestock."

2. "Effectively Presenting Market Information."

3. "Know Your Country Cousin."

4. "Improved Dissemination of Market Information."

PROGRAM

NATIONAL MARKETING SERVICE WORKSHOP

West Lafayette, Ind., November 15-17, 1955

Theme of Conference: Strengthening Marketing Service Programs through Use of Recent Research Findings

Headquarters: Student Union Building, Purdue University

Tuesday, November 15

9:00 a.m. GENERAL SESSION

L. G. Foster, Liaison Office, State Departments of Agriculture, Agricultural Marketing Service, U.S.D.A. - Chairman

Invocation - Hon. C. J. Carey, Deputy Director, California Department of Agriculture

Welcome - Dr. F. C. Hockema, Vice President, Purdue University

Plans for the Workshop - William C. Crow, Liaison Officer, State Departments of Agriculture, Agricultural Marketing Service, U.S.D.A.

Keynote Address - The Role of Marketing Services in Improving the Marketing of Farm Products, Hon. D. N. McDowell, Director, Wisconsin Department of Agriculture

10:30 a.m. - 12:00 noon MEETINGS OF FIRST WORK GROUPS

A. Maintaining the Quality of Dairy Products

Chairman - Harvey J. Weavers, Wisconsin Department of Agriculture
Secretary - J. C. White, Cornell University, Ithaca, N.Y.
Speaker on Research - F. E. Fenton, Dairy Division, A.M.S., U.S.D.A.

B. Maintaining the Quality of Grain and Oilseeds

Chairman - John Winfield, North Carolina Department of Agriculture
Secretary - Mark D. Worcester, U. S. Fish and Wild Life Service, Bismarck, N. D.
Speaker on Research - William C. Dachtler, Market Organization and Costs Branch, A.M.S., U.S.D.A.

C. Reducing Deterioration and Spoilage of Fruits and Vegetables in Marketing Channels

Chairman - George H. Chick, Maine Department of Agriculture
Secretary - Leon Scott, Mississippi Department of Agriculture
Speaker on Research - Harold T. Cook, Biological Sciences Branch, A.M.S., U.S.D.A.

D. Maintaining Quality of Poultry and Eggs

Chairman -Tom Fox, Oklahoma State Board of Agriculture
Secretary - Hunter Hering, Michigan Department of Agriculture
Speaker on Research - Lyle L. Davis, Biological Sciences Branch, A.M.S., U.S.D.A.

E. Quality Maintenance and Grading of Livestock

Chairman - Clifton B. Cox, Purdue University, Lafayette, Indiana
Secretary - Amos Meyer, University of Maryland, College Park, Maryland
Speakers on Research - George Henning, Ohio State University; C. D. Phillips, University of Kentucky; and H. M. Riley, Michigan State University
Consultant - John C. Winter, Transportation and Facilities Branch, A.M.S., U.S.D.A.

1:30 p.m. GENERAL SESSION

William C. Crow, Liaison Officer, State Departments of Agriculture, Agricultural Marketing Service, U.S.D.A. - Chairman

Does Distribution Cost Too Much? Omer W. Herrmann, Deputy Administrator, Agricultural Marketing Service, U.S.D.A.

2:30 p.m. - 5:00 p.m. MEETINGS OF FIRST WORK GROUPS (Continuation)

7:30 p.m. GENERAL SESSION

Hon. J. B. McLaughlin, Commissioner, West Virginia Department of Agriculture - Chairman

Movies Useful in Marketing Service Work

a. Modernizing Marketing Facilities

b. The Egg and You
c. Sorting and Sizing Apples
d. Handling Peaches

Wednesday, November 16

9:00 a.m. GENERAL SESSION

L. G. Foster, Liaison Office, State Departments of Agriculture, Agricultural Marketing Service, U.S.D.A. - Chairman

How Research Results Can Be Used to Reduce Marketing Costs
Max E. Brunk, Professor of Marketing, Cornell University, Ithaca, N.Y.

10:00 a.m. - 12:30 p.m. MEETINGS OF SECOND WORK GROUPS

A. Increasing Sales of Dairy Products

Chairman - Donald Wilkinson, Wisconsin Department of Agriculture
Secretary - Mancil J. Vinson, Kentucky Department of Agriculture
Speaker on Research - Shelby A. Robert, Jr., American Dairy Association, Chicago, Ill.

B. Reducing Costs of Handling Grain

Chairman - John Winfield, North Carolina Department of Agriculture
Secretary - W. L. James, Virginia Department of Agriculture
Speaker on Research - William C. Dachtler, Market Organization and Costs Branch, A.M.S., U.S.D.A.
Consultant - John C. Winter, Transportation and Facilities Branch, A.M.S., U.S.D.A.

C. Improving Containers and Methods of Packaging Fruits and Vegetables

Chairman - George H. Chick, Maine Department of Agriculture
Secretary - Walter S. Mason, New York Department of Agriculture
Speaker on Research - Donald R. Stokes, Transportation and Facilities Branch, A.M.S., U.S.D.A.

D. Reducing Costs of Marketing Poultry and Eggs

Chairman - Tom Fox, Oklahoma State Board of Agriculture
Secretary - R. J. Park, Tennessee Department of Agriculture
Speaker on Research - John Scanlan, Poultry Branch, Farmer Cooperative Service, U.S.D.A.

E. Country Livestock Auctions

Chairman - Clifton B. Cox, Purdue University, Lafayette, Indiana
Secretary - Claude R. Underwood, West Virginia Department of Agriculture
Speaker on Research - Cortes G. Randell, Livestock and Wool Branch, Farmer Cooperative Service, U.S.D.A.

1:45 p.m. GENERAL SESSION

Hon. Roy Freeland, Secretary, Kansas Board of Agriculture - Chairman

Effectively Presenting Market Information - Stanley Andrews, Executive Director, National Project in Agricultural Communications, Michigan State University, East Lansing, Michigan

2:45 p.m. - 5:00 p.m. MEETINGS OF THIRD WORK GROUPS

A. Reducing Costs of Handling Milk

Chairman - Harvey J. Weavers, Wisconsin Department of Agriculture
Secretary - V. C. Manhart, Purdue University, Lafayette, Indiana
Speaker on Research - Charles E. French, Purdue University, Lafayette, Indiana

B. Grading Grain and Oilseeds

Chairman - John Winfield, North Carolina Department of Agriculture
Secretary - John Mahoney, University of Maryland, College Park, Maryland
Speaker on Research - Lawrence Zeleny, Grain Division, A.M.S., U.S.D.A.

C. Reducing Costs of Handling Fruits and Vegetables

Chairman - George H. Chick, Maine Department of Agriculture
Secretary - Davis Foreman, Illinois Department of Agriculture
Speaker on Research - Joseph F. Herrick, Jr., Transportation and Facilities Branch, A.M.S., U.S.D.A.
Consultant - Max E. Brunk, Cornell University, Ithaca, New York

D. Expanding Sales of Poultry and Eggs

Chairman - Tom Fox, Oklahoma State Board of Agriculture
Secretary - Stanley Painter, Maine Department of Agriculture
Speaker on Research - J. M. Gwin, Poultry and Egg National Board, Chicago, Ill.

E. Improving the Handling and Increasing the Demand for Meat

Chairman - Clifton B. Cox, Purdue University, Lafayette, Indiana
Secretary - C. P. McClaugherty, Virginia Department of Agriculture
Speaker on Research - D. E. Brady, University of Missouri, Columbia, Mo.
Consultant - Raymond W. Hoecker, Transportation and Facilities Branch, A.M.S., U.S.D.A.

6:30 p.m. BANQUET AND ENTERTAINMENT

Toastmaster - Hon. Roy Freeland, Secretary, Kansas Board of Agriculture

Know Your Country Cousin, Dr. R. L. Kohls, Purdue University, Lafayette, Indiana

Thursday, November 17

9:00 a.m. GENERAL SESSION

Hon. L. Y. Ballentine, Commissioner, North Carolina Department of Agriculture - Chairman

Panel Discussion on Expansion of Market Outlets

a. The Role of State Agricultural Extension Services in Expanding Outlets, Raymond C. Scott, Federal Extension Service, U.S.D.A.

b. The Role of State Departments of Agriculture in Expanding Outlets by Putting into Practice the Results of Research, George H. Chick, Maine Department of Agriculture, and Dr. Alvah L. Perry, Agricultural Experiment Station, University of Maine

c. The Role of the Food Distribution Division, A.M.S., U.S.D.A., in Expanding Outlets, G. Chester Freeman, Food Trades Branch, Food Distribution Division, A.M.S., U.S.D.A.

10:45 a.m. - 12 noon

MEETINGS OF FOURTH WORK GROUPS

A. Organizing the Resources of Public Agencies and Industry to Move Commodities in Plentiful Supply

Chairman - John Mahoney, University of Maryland, College Park, Maryland
Secretary - Kenneth R. Slamp, Pennsylvania Department of Agriculture
Speaker on Research - Raymond Wilson, Purdue University, Lafayette, Indiana
Consultant - G. Chester Freeman, Food Trades Branch, Food Distribution Division, A.M.S., U.S.D.A.

B. Improved Dissemination of Market Information

Chairman - Roy Bodin, Minnesota Crop Reporting Service, St. Paul, Minnesota
Secretary - George Aull, Clemson College, Clemson, South Carolina
Speaker - John H. Wessels, Director of Information, Virginia Department of Agriculture and Immigration
Consultant - Stanley Andrews, Executive Director, National Project in Agricultural Communications, Michigan State University, East Lansing, Mich.

C. Improving the Transportation of Farm Products

Chairman - Mancil J. Vinson, Kentucky Department of Agriculture
Secretary - Howard P. Brossett, Louisiana Department of Agriculture
Speaker on Research - John C. Winter, Transportation and Facilities Branch, A.M.S., U.S.D.A.

D. Improving Wholesaling and Retailing

Chairman - Donald Wilkinson, Wisconsin Department of Agriculture
Secretary - Taylor Grizzard, Virginia Department of Agriculture
Speaker on Research - Raymond W. Hoecker, Transportation and Facilities Branch, A.M.S., U.S.D.A.

1:30 p.m. - 3:00 p.m. MEETINGS OF FOURTH WORK GROUPS

(Continuation)

3:15 p.m. GENERAL SESSION

Hon. C. J. Carey, Deputy Director, California Department of Agriculture - Chairman

Summary Reports by Chairman of each of the 19 Work Groups

Observations on Workshop - Hon. L. Y. Ballentine, Chairman of the Advisory Committee on Cooperative Work under the Agricultural Marketing Act with State Departments of Agriculture

Concluding Remarks - William C. Crow, Liaison Officer, State Departments of Agriculture, Agricultural Marketing Service, U.S.D.A.

PLANS FOR THE WORKSHOP

William C. Crow, Liaison Officer,
State Departments of Agriculture,
Agricultural Marketing Service, U.S.D.A.

The Agricultural Marketing Act of 1946 was enacted to find better ways of marketing through research and to put these research findings to use by service and education. Since that Act was passed, marketing work has been improved in many States.

The theme of this workshop is "Strengthening Marketing Service Programs Through Use of Recent Research Findings." Its purpose is to improve marketing service programs conducted by State Departments of Agriculture by presenting a number of recent practical research results and by showing how marketing service people can assist producers, firms, and agencies engaged in marketing in applying these findings and adopting other improved marketing practices.

This workshop is being held at the direction of the committee representing the State Departments of Agriculture, and the program was planned largely by representatives of the States. In other words, it is your workshop—it is not for the U. S. Department of Agriculture. The subjects to be studied are the ones in which your States are interested.

The program will consist of general sessions, to start each morning and each afternoon, to be attended by all of you, and of 19 work group sessions, several of which will meet simultaneously. At the general sessions there will be speeches, a panel discussion, and movies on subjects that will interest the entire group. On Wednesday evening there will be a banquet.

Each person attending the workshop should select four work group meetings in which he will participate, and is expected to choose those subjects that will assist him most in his work. It is also expected that each person will stay in these groups until the discussion of the problem has been completed and the report written. At each work group meeting a research man will introduce the subject by presenting practical research results which can be used by marketing service people and will answer questions. All members of the group will then participate in a discussion of the subject and help in reaching conclusions as to the best contribution marketing service people can make to the solution of the problem being discussed. These conclusions will be presented by the chairmen of the groups at the closing general session on the last afternoon of the workshop. The reports of the 19 work groups and the speeches will be published in the proceedings of the workshop, which will be sent to each person attending the conference.

This conference is called a "workshop" because we all came here to work. Every person here is a teacher and is expected to contribute. Also, every person here is a student expecting to learn about practical recent research findings that he can use, and gain useful information about the experiences of other States. You will have an opportunity to discuss with these researchers

and with representatives of other States how to apply our research findings. How much you will get out of the workshop depends upon how much you put into it. The program is good. It is, therefore, up to you to put forth every effort possible to obtain the maximum benefit from the opportunities that this workshop offers.

THE ROLE OF MARKETING SERVICES IN IMPROVING THE MARKETING OF FARM PRODUCTS

D. N. McDowell, Director,
Wisconsin Department of Agriculture

I believe it proper that we briefly review the general functions of State Departments of Agriculture in all of the several States. We recognize that our legislatures have given varied responsibilities to the Departments and that this delegation of authority has been based largely on conditions within each of the several States. These functions cover the generally recognized pattern of services and regulatory and promotional functions which have been found necessary.

Among these various functions assigned to our Departments are marketing service functions, grading work, and a definite emphasis in the field of basic data.

One of the greatest challenges facing us today is the accepting of responsibilities and duties which are ours to carry out, including market service work which has been initiated as a joint program between the State and Federal Governments in the Agricultural Marketing Act of 1946.

Departments of Agriculture are developing new strength in this AMS work. At first there were only a few Departments which were able to undertake what we then called RMA projects, and in the beginning there were only a few projects, mostly small ones. Now each year more Departments are coming into the program, and each year more and larger projects are developed.

The expanded work in this field, due to both the volume and quality of work, leads to the need for a new emphasis in coordination.

We would like to suggest three areas in which we feel coordination is necessary:

1. With other agencies within the States.
2. Between States.
3. With the U. S. Department of Agriculture.

With a common understanding of mutual objectives, we should be able to see more coordination of programs, which in the past have been somewhat scattered and unrelated to other work that is being done by the various agencies.

We would like to call your attention for just a moment to the various marketing functions with which we are all familiar; namely, the various aspects of assembling, handling, processing, packaging, storing, distributing, and retailing. We must analyze all of these marketing functions, recognizing that market service work has a definite responsibility from the time the product is produced on the American farm until the time it reaches the ultimate consumer.

America is burdened with many antiquated marketing practices, including such things as inefficiency in assembling and obsolete processing methods. Packaging techniques are far behind and seriously in need of improvement; point of sales efforts have lagged on the part of farm products; and all other services need a good look-see toward new ideas and greater efficiency. We probably need more centralization of assembling points in agriculture; that is, we may need fewer such points but larger and more efficient ones. Bigger trucks, bigger loads, and proper packaging should help to lower per unit costs.

Millions of dollars are being spent today on market research, but this is lost unless these results are put to use in a practical, usable way. Some of the research results that are available give information on:

1. How to improve all kinds of marketing facilities.
2. How to reduce costs of handling.
3. How to maintain quality.
4. How to improve transportation.
5. How to grade, pack, and handle many of our farm commodities.

Each and every State should be completely familiar with all results that can be used in its market service program in order that marketing firms may be serviced properly and helped in doing a better job.

We have today many services which are being carried on very efficiently and certainly to the benefit of agriculture. I would like to mention just a few of these:

Market News Service work is being carried on jointly between the States and Federal Government. This is probably the oldest marketing service in America. The need for the service is changing. We must stay abreast of the demands. We must supply the needed information when needed and in a form that can be understood.

The well-known Crop Reporting Service, likewise a joint project, offers one of the greatest challenges in our market service work. The collection and dissemination of crop and livestock reports and dairy and other produce activities place a distinct responsibility on each and every one of our States. This information covers the field of production, marketing, utilization of products, prices received, and prices paid. I will have more to say about this important responsibility in just a minute.

Another of the already established marketing services is that of setting up grades and standards for our food and fiber crops of America. Our problems hinge around the realization that we must set standards that accurately measure quality, and that at the same time are practical from the standpoint of the producer and acceptable to the consumer.

Further, it is our responsibility, after we have the proper grades and standards, to see to it that they are presented in such a way that they are understood and made to be a valuable asset in the marketing process.

Our job in this field of marketing is not one which is at a State level. We must have unity and coordination between States and between agencies. To use one of the old proverbs, we must be "our brother's keeper." We must not use the philosophy, "Let George do it."

In our AMS work which we all are carrying on, there are three distinct responsibilities and obligations that we must share:

1. We must have adequate projects basic to American agriculture.
2. Projects are only as good as they are administered; therefore, they must be sufficiently and efficiently administered.
3. They must be properly reported. Unless the results of the work being done are presented in a clear, concise manner we shall fail in our responsibility to pass this information on to those who need it in the particular commodity fields.

We must make better use of both basic data and current research. May I suggest that we re-evaluate the work we are doing in agricultural statistics, because it is undoubtedly the key to much of the work that is going to be done in the months and years ahead. This statistical work is now being done by Departments of Agriculture, with but a few exceptions. We are approaching another horizon, or may we call it a new era of opportunities and responsibilities.

County and community data are needed as a basis for much of the educational and extension work which is being done. Some of our States have pioneered in this county statistical work and have made great progress. Others must recognize the demand and proceed immediately to fill this need.

It is not easy to provide such data, but as our work continues in this direction, ways have to be found to better the procedure for collecting the information, as well as to improve our methods of dissemination. Are we, in our several States, going to meet this challenge? Who is to do the job if we, who are equipped to do it, fail? Others will and must do it, if it is not done by the agencies now equipped to follow through.

In all of our work, we need to be much closer to our colleges and to industry. Through this workshop, and through our own personal enthusiasm back home, we must stimulate new life and purpose for market service activities. The potential is tremendous.

Many States are doing a good job toward improving this market service work. Others have programs that are as poor as when the Act was passed. In many States, the marketing programs are one-sided. Some States are doing nothing to contribute to this effort of balance and coordination. Neither are they contributing to the marketing work in their own State Departments of Agriculture. Unfortunately, some of the States which do have good programs choose not to contribute to a workshop such as ours. This workshop is an opportunity and a duty for each of us. It is an opportunity to learn from research people, results that can be applied. There is no other place to get so varied research results from such excellent authorities in so short a time as we can in these three days.

We are going to have an opportunity to learn from the experiences in other States. It seems to us that it is a duty of every State participating in matched-fund-program work to contribute from their experiences and ideas for the common good.

Our marketing service work fills a real need because marketing is the major problem facing American agriculture today. This work can be the most popular type of public service, because it gives the people the answers they need. To do this job, however, we cannot be content with our past accomplishments. We must learn and progress. The opportunities are here before us. The question that must be answered by each and every one of us personally is: "To what extent will we do something specific about them?"

We have acquired a lot of valuable experience in AMS work since the Agricultural Marketing Act was passed nearly 10 years ago. Workshops such as these give us a chance to pool our experiences and to counsel with one another as to how we can do a better job in the future. I am sure that State Departments of Agriculture have already made much headway under this important program and found that progress already made is a springboard to much more that we will have to do in the years ahead. The answer depends in part on what you and I put into and get out of this three-day program.

MAINTAINING THE QUALITY OF DAIRY PRODUCTS

F. E. Fenton, Dairy Division,
Agricultural Marketing Service, U.S.D.A.

Methods and techniques of processing and handling dairy products are constantly changing in response to changing market conditions. In some cases these changes result in improved quality of milk and dairy products. In other cases, the opposite may be true.

Many of our problems of maintaining quality come from either overlooking some phase of basic knowledge which we already know or being unaware that such information already exists in the literature available. If all of us, by some miracle, could apply all that we have learned or all that anyone else already has learned thus far, we could do a pretty good job of marketing high quality products. We have discovered through formal research and trial-and-error methods

during the last 50 years much more than we are applying properly today. The availability of this knowledge does not mean that we should cease our efforts for fact-finding, but that we should sharpen our efforts to better utilize what we already know.

We have known for many years the role that bacteria play in the development of off-flavors in milk and milk products and the need for the utmost sanitation in all phases of the operation. However, we have failed to apply that information in many instances, with the result that we have continued to manufacture dairy products which are not representative of the best that we know. We have known for many years the role that refrigeration plays in the control of bacterial activity, yet we have neglected to apply that knowledge widely enough to prevent the large amount of deterioration that is taking place all along the marketing line.

Any change should be studied in the light of what we already know, and steps should be taken to prevent the same mistakes again. For instance, it has been known for many years that the agitation of warm raw milk at about the temperature it is drawn from the cow causes a form of rancidity very quickly. Yet we were slow to apply this information when we got into the rapid development of pipeline milkers and bulk tanks until we found ourselves faced with off-flavored milk and began to look for the reason.

Research has brought us new ways of doing things—many times at a saving in time and expense—but it also has brought added problems with which we must reckon. That is why we are here to review some of those changes and to renew our efforts to apply what we already know in achieving our goal. For that reason much of what will be said here will deal with facts you have heard many times. We dislike having to repeat them so often, yet they must be repeated again and again until we do something about them.

As a refresher then, let us remind ourselves that the maintenance of quality in dairy products depends on three basic conditions: (1) Sanitation, (2) time, and (3) temperature. Every product has a life expectancy dependent upon its inherent make-up, the way it has been made, the care with which it has been protected from contamination, and the temperature at which it has been maintained throughout its life. There is a direct relation between the length of time a product will hold up and the temperature at which it has been held.

If we were constantly aware of the factors of sanitation, metal contamination, and refrigeration, we would go a long way in improving the quality of dairy products and also in increasing their stability and shelf life. These basic factors are simple, but often one or more of them may be overlooked in our daily routine methods of handling.

Some Quality Factors at the Farm Level

So much of the keeping quality of dairy products is dependent upon the inherent properties of the raw material and the way in which the product is processed at the outset that in our discussion today it will be difficult to

separate our consideration of "Manufacturing Quality Dairy Products" from our discussion of "Maintaining the Quality of Dairy Products." The two are closely related, and for that reason much that will be said deals with technique and precautions necessary in the production of the raw material and processing as well as those factors which have a bearing on the maintenance of the quality after manufacture.

We need to be reminded constantly that the quality of the raw material is of utmost importance in the kind of product the consumer will receive. However, we should face the facts and realize that we have left this phase of our program sadly neglected through the years. We have gone to great expense to develop machinery and techniques to make a "silk purse from a sow's ear." We are just now coming to the realization that it cannot be done, although our research through the years has constantly told us that. We seemed unwilling to accept facts.

We have known for years the importance of the health of the cow in the production of normal high quality milk. It has been pretty well established now that acidosis or Ketosis is responsible for much of the "cowy" or "barny" flavor often found in milk. Mastitis milk continues to plague us, and we have much to learn before it will become a minor factor in the production of high quality milk. Mastitis is one of the most troublesome and costly problems confronting the dairymen today. It differs from brucellosis and tuberculosis in that many types of bacteria are associated with bovine mastitis. The causes of mastitis are lack of good, adequate housing, good herd management, and good sanitation.

The State of New York has adopted a clinical and bacteriological program for the control of mastitis based on three phases: (1) Accurate diagnosis, (2) prevention by good sanitation and management, and (3) treatment of certain quarters. A necessary supplement to good diagnosis and prevention by good sanitation and management is the use of carefully selected treatments by veterinarians to eliminate infections already established.

Various antibiotics such as penicillin, aureomycin, and terramycin are used today by veterinarians in the treatment of infected quarters. Antibiotics may be present in milk as a result of their use in the treatment of udder infections. The presence of antibiotics in milk inactivates the desirable types of bacteria that are responsible for the action of our cultures. The degree of inhibition of a lactic culture in milk containing an antibiotic is related to the type of antibiotic present, its concentration, and the sensitivity of the culture.

Krienke (1) 1/ has reported that as little as 0.1 unit of penicillin per ml. of milk can retard acid production to a great extent.

Baker (2) states; "In herds where good diagnosis is used and the treatment program is well planned, followed by withholding of the milk from treated

---

1/ Numbers in parentheses refer to "Literature Cited," pp. 33-36.

quarters for at least 72 hours or until secretions become normal, the quality of the milk is improved."

It should be kept in mind that the Federal Food and Drug Administration has concluded that the direct or indirect addition of antibiotics to foods for human consumption constitutes a public health hazard. (3) The reason for this conclusion is that food so treated may cause sensitization of the consumer to such antibiotics and may result in the emergence of strains of pathogens resistant to these drugs. Foods for human consumption are considered adulterated if they contain antibiotics.

The treatment of mastitis infections with antibiotics has brought numerous headaches to our cheesemakers and cultured milk processors in combating its effects. So long as antibiotics are being used promiscuously, they will continue to be responsible for slow-acting vats of cheese which, if saved at all, are apt to be of low quality.

The feed that the cow consumes has a direct bearing upon the flavor of the milk, and for that reason we try to stress the importance of keeping cows away from obnoxious weeds, such as onions and bitterweed, and even of avoiding feeding certain normal feeds, such as alfalfa hay and silage, after milking to prevent their flavor being carried over into the milk. These are old recommendations, but we continue to produce far too much milk which must be graded down because of serious feed flavor defects.

After the milk has been produced the changes that take place can be generally classified as chemical and bacteriological.

Chemical Changes. The chemical changes dealing with the changes in the fat phase of the milk which are most troublesome are rancidity, or lipase induced flavor, and oxidation or oxidized flavor.

The rancidity referred to is generally agreed to result from a splitting of the fat phase by the enzyme lipase, which is greatly stimulated by excessive agitation at warm temperatures in the presence of air. The problem is receiving increased attention with the expansion in pipeline milkers and farm tanks.

Herrington (4) reports that the use of pipeline milkers renders milk much more susceptible to lipase action during subsequent storage. He states:

> "There is much difference in the response of milk from different herds to such treatment. Some are much more sensitive than others. Most of the effect is due to risers; elimination of all risers will greatly reduce the number of cases of rancidity.
>
> "The importance of the problem is not generally realized because the rancid milk is diluted in the tank truck with good milk. As the number of pipeline milkers increases, there will be less good milk available for dilution, and the frequency of complaints will increase.

"The acceleration of lipase action is associated with foam production. Warm milk can be agitated with great violence without harm, provided that no foam is produced.

"Pipeline milkers should be designed and operated so that foam production will be kept at an absolute minimum."

Kelly and Dunkley (5) report that rancidity in milk by activation treatments in pipeline milkers has been encountered on a number of ranches. They list the following among the major contributors to induced rancidity:

1. Admission of air to the milk lines.
2. Low milk flow-rate.
3. Elevation of warm milk under vacuum with air bubbling through it.
4. Inclusion of a filter and numerous fittings in the vacuum-section milk line.
5. Continuous operation of a starved centrifugal pump.

They also report that rancidity can be induced in most raw milk by activation treatments such as agitation of warm milk, including homogenization, or temperature fluctuation treatments involving cooling milk, warming it to about 86° F., and cooling it again. The effects of such activation treatments appear to be dependent upon changes in the milk fat globule.

Rancidity, as it is being encountered at the farm level, is influenced by: (1) Type and operation of equipment, (2) characteristics of the cow, (3) stage of lactation, and (4) feed of the cows.

There will be problems in making the switch from cans to bulk, but they are not insurmountable. The bulk milk-cooling tank for farms and the bulk pick-up system should be considered as a means of improving the quality of the milk--physically and bacteriologically--and the operation of such a system should materially improve the operating efficiency, thereby reducing the cost of handling quality milk.

Oxidized and metallic flavors are major problems confronted by the dairy industry. Copper is often responsible for oxidized flavor, and its presence in freshly drawn milk has been reported by various investigators. Supplee and Bellis (6) indicated that copper may be expected naturally in cows milk to the extent of about 0.52 parts per million on the average. Several investigators reported the values varied from 0.06 to 0.80 p.p.m. Extremely small amounts of copper, which the milk picks up from equipment and utensils made of copper or copper-containing white metals, will frequently cause an oxidized flavor. Rusty cans contribute toward the development of metallic flavor in milk and cream. The effect of metals will be covered later as we discuss the defects of the finished products.

Bacteriological Changes. In contrast to the chemical changes which concern mainly the fat phase of the milk, the bacteriological changes affect the protein and the lactose portions of the milk.

Sanitation is the key word when dealing with changes brought about by bacterial action. Milk from healthy cows is normally of low count and, therefore, would be no problem were it not for contamination of bacteria in the normal course of handling. That is why keeping all equipment clean and sanitized becomes an eternal problem in the food industry, particularly with milk.

The changes which take place in the lactose portion of the milk are familiar to all of us in the dairy industry because of the acid production which results from the change in lactose to lactic acid by Strep. lactis organisms. Other changes occur also, but lactic acid is the most prevalent. Changes which take place in the protein portion are of a more complex nature and involve a wider scope of bacterial action. We are being more conscious of these protein changes as we learn more about flavor changes that affect dairy products.

Through the increased use of refrigeration, as with farm tanks, and through longer holding of the finished products under refrigeration, we are forced to deal with a group of bacteria that are able to grow at 35° to 45° F., although at a much lower rate, and produce off-flavors which no longer can be ignored.

It is this group of bacteria attacking the protein of the milk that give us much of our trouble with off-flavors and poor keeping quality of finished products. More attention will doubtless be given in the future to types of organisms present in milk, particularly those growing at low temperatures or those surviving pasteurization, than with total bacterial count, since refrigeration can and does distort the meaning of a high total bacterial count.

Transportation from Farm to Plant. In the long line of marketing progression, any phase which neglects the fundamental rules of sanitation, refrigeration, and time will put its stamp of neglect upon the product which cannot be erased. No step in that progression has been more neglected than that of faulty transportation and containers used in transit.

Careful handling at the farm can all be nullified by putting milk in improperly cleaned or rusty tin cans and permitting it to splash around on hot dusty roads for several hours before delivery to the plant.

Small amounts of milk in a 10-gallon can not only will warm up quickly, but the constant agitation is believed to be responsible for much of the metallic, unclean flavors found in milk products.

Bulk tank pick-up of cold milk at the farm and hauling in insulated tank trucks will solve some of our quality maintenance problems in those areas where tanks are being installed on a wide scale. However, we cannot overlook the fact that many gallons of milk and cream will still move to market in the conventional 10-gallon can and in nonrefrigerated trucks, and this situation is likely to be with us for some time.

Some Quality Factors Influenced by Processing

A master craftsman who sets out to build a fine piece of furniture selects the highest quality wood or material on which to use his skill. Many illustrations might be cited in any field to show the importance of the selection of the good quality raw material as the beginning of good finished products. There are too many buttermakers and plant operators who do not recognize that they are wasting their time in trying to make good dairy products from poor or mediocre raw material. Fortunately, more and more we are coming to realize that we have neglected that phase of our quality program and are beginning to give greater attention to the quality of raw material going into the manufacture of dairy products.

The selection and grading of raw material to meet a specified standard is a prerequisite of quality dairy products. The day of accepting anything the farmer offers for sale in the form of milk or cream is on its way out. We have a responsibility to hurry this development along in our quest for improved quality. Uniformity, as well as high quality, is important and can be accomplished only by grading raw material carefully and consistently according to an accepted standard. We also should be working to establish a higher standard below which milk or cream will not be acceptable.

Many laboratory tests have been developed and are being used for that purpose, but the oldest, fastest, and still most reliable, is the organoleptic method, of sight, taste, and smell, when conscientiously done by a carefully trained individual. Such grading may be supplemented to good advantage by bacterial and chemical tests, but the sense of taste and smell will go a long way in improving the bulk of our dairy products.

What we have said thus far has been concerned with milk and cream generally. For the sake of brevity we will be able to discuss only a few processing procedures which have a direct bearing on the quality of a limited number of finished products, particularly butter and cheese.

Can Steamings. In the manufacture of butter, one of our biggest headaches is what to do with can steamings—that is, the cream left sticking to the sides of the cans when the cream is dumped. Metallic flavor or the off-flavor arises from any cream exuded from broken seams or rusty areas in the cans. Such material goes into the cream vats in varying amounts in plants churning butter today, and is responsible for a heavy share of metallic and other utensil and unclean flavors in butter. Such butterfat cannot economically be discarded; therefore we should place our emphasis on improving the condition and quality of the cans used to store and transport cream and milk.

Giroux, Bryant, and Sproule (7) conducted a study of the possible effects of storage and transportation in various types of cans upon the quality of dairy products. Studies were made on cream, the butter made from it, and fluid whole milk. The first emphasis was placed upon cream because this product remains in the can for a longer period, on the average, than other products. The figures for the iron content of cream stored in all types (aluminum,

stainless steel, new tinned steel, and Pyrex glass) of experimental cans, except the slightly and very rusty cans, were not significantly different and are in the lower part of the range (1.2 to 3.5 p.p.m.) given by McDowell (8). The average iron content for 45 samples was 1.06 p.p.m. plus or minus a standard deviation of 0.34 p.p.m.

The average iron content of cream stored in slightly rusty cans was four times greater than the iron content in the nonrusty containers, the value being 4.63 ± 2.25 p.p.m. (16 samples).

In the case of the cream stored in very rusty cans, the iron contents were very variable, ranging from 9.4 to 67 p.p.m. with the average of 29.6 ± 24.8 p.p.m.

On the fifth day of storage the creams were neutralized, pasteurized, and churned. The butters from the creams stored in the slightly rusty tinned steel cans contained 0.85 ± 0.42 p.p.m. iron, as compared to an average iron content of 0.5 p.p.m. for all other nonrust types.

Butter from cream stored in very rusty cans contained 6.6 ± 3.3 p.p.m. of iron which is six times the safe limit - Julien and Martin (9).

The milk study showed that the same trends in metal content were found as in the case of cream and butter. The iron contents for the milks were as follows: The average for the group aluminum, stainless steel, new tinned steel, and Pyrex glass was 0.48 ± 0.15 p.p.m.; for the slightly rusty group, 1.00 ± 0.24 p.p.m.; and for the very rusty group, 2.00 ± 1.4 p.p.m.

The increased use of stainless steel has greatly reduced metallic contamination in plants, but the continued use of old pumps, or pumps constructed of alloys containing large amounts of copper, increases the metallic content of the product more than is commonly realized. In some work reported by Mitten (10), when metals of differing resistance were in contact, the corrosion factor was greatly increased. For instance "a piece of steel 1 inch square coupled to copper of 50 sq. inch would corrode about 50 times faster than if the areaswere equal." Mitten goes on to say, "Your equipment manufacturer has taken this into account in his design. It is necessary that users of equipment exercise care in connecting piping or other equipment made of materials other than stainless steel." This problem involves a technical study in itself and time will not permit our discussing it further.

Pasteurization and Processing Techniques. Pasteurization and processing techniques contribute their share of causes of defects in the finished products. Proper pasteurization, again involving time and temperature, is very important. Newer types of equipment using higher temperatures are becoming more widely used, but the care with which the product is handled at the beginning and ending of the pasteurization process of the flash method needs close attention. In many smaller plants where vat pasteurization is still practiced and only partially filled vats are heated, the foam or surface portion of the product may not receive sufficient heat treatment. The use of

proper thermometers and recorders are important tools to assure proper processing.

Proper neutralization of sour cream for butter making needs careful and skilled attention to avoid over- or under-neutralization. The results of voluntary analytical programs carried on by many of the colleges in their respective States have revealed wide variations in the pH values of butter, indicating a lack of uniformity in neutralization. Butter with a low pH (acid) in the presence of high metallic substances, particularly copper, will result in oily, fishy flavors in a comparatively short time. Butter with a high pH (alkaline) will encourage certain putrefactive flavor development. Tallowy and alkaline (soapy) flavors are also found more frequently in butter improperly neutralized.

This information is old, but these flavors are still being encountered in the routine grading by the USDA butter graders.

The control of pH in the manufacture of cottage cheese is also important in the prevention of certain bacterialogical defects as will be mentioned later. Although the pH of itself is not a factor, it does indicate a favorable or unfavorable environment for certain bacterial or chemical actions.

Nonwashing of Butter. During the last several years some interest has developed in this country in the manufacture of nonwashed butter. A few creameries have eliminated the washing mainly due to contaminated water supplies. It is not possible to arrive at any simple conclusion as to the overall effect on quality.

The manufacture of nonwashed butter has been practiced in other countries for quite some time. Pont (11) reported the results of 74 experimental churnings made during 1946 from five Australian butter factories, without the use of any wash water, selected to give a range of cream type and grade. The same number of normally washed controls were made--the control was a churning washed in the normal way and made in the same churn from the same vat of cream. When graded one week after manufacture, there was no difference in score between the washed and nonwashed butters. After 3 months' storage at 16° F. the washed butter was graded higher in 36 out of 68 cases, the unwashed butter was graded higher in 16 instances, and no distinction was made in 16 instances. The curd content of the nonwashed butters was on the average 0.42 percent higher than in the washed butters (1.10 percent vs. 1.52 percent). The results, however, did not indicate that the mere presence of increased curd in this range was a factor in quality deterioration. The bacterial counts showed considerable variations and in some plants were higher in the washed butters than in the nonwashed butters. The results of this investigation indicate that nonwashing is without apparent effect on initial quality but is accompanied by an element of risk to the keeping quality.

Pont (12) also reported a study in 1948 at five Australian butter factories, involving 105 churnings of unwashed butter and the same number of normally washed controls. This study dealt with the effect of eliminating

the usual washing procedure on curd content, initial quality, quality after holding at atmospheric temperature for 2 to 3 weeks and after cold storage at 16° F. for 4 to 5 months, pH of the butter serum, copper and iron content, and the degree of fat oxidation during cold storage as measured by peroxide and aldehyde values. There was no significant difference in keeping quality between the two classes of butter either at room temperature or in cold storage. At two of the five participating factories, however, the initial grade was significantly lowered when the butter was not washed, the average difference in grade being 0.20 and 0.15 points.

Unwashed butter was found to have an increased curd content of about 0.43 percent. Bacterial and yeast counts were higher in the unwashed butter by about 40 percent, although wide variations covering different types of counts were encountered. The copper content of unwashed butter was consistently higher by about 20 percent and the results of iron analysis showed a similar trend. The pH value of the butter serum was lower by about 0.1, factory average differences ranging from 0.02 to 0.14 pH. The degrees of fat oxidation after cold storage tended to be less in unwashed than in washed butter at levels of copper content below 0.10 p.p.m. and approximately equal at higher levels (0.1 to 0.2 p.p.m.). The increased curd constituents in unwashed butter exert a slight but distinct antioxidant effect at copper levels below 0.1 p.p.m.

Pont states, "Factories contemplating the manufacture of unwashed butter should consider the possibility of losing some quality as a consequence."

White and Riel (13) in a recent paper reported their 1953 studies on nonwashing of butter. Churnings of washed and nonwashed butter were made in 29 Canadian creameries from split vats of cream of varying quality. The butters were stored at -5° F. and scored monthly for 6 months. White and Riel reported no significant difference in the flavor quality of comparable butters before and after storage. Increases in curd content due to nonwashing ranged from 0.35 to 0.55 percent and averaged 0.53 percent. There was no consistent pattern to the bacteria and mold and yeast counts of comparable butters, and no relationship was noted between microbiological content and flavor scores. Peroxide and fat acidity values were similar for both butters before and after storage; pH values on nonwashed butters were slightly lower than for the washed butters and were mostly in the range of 7.0 to 8.0.

Influence of Psychrophilic Organisms. Post-pasteurization contamination, as indicated by the presence of psychrophilic bacteria in the finished products, will need greater attention in the future as we give more stress to greater stability and shelf life to dairy products. Psychrophilic bacteria (those growing at low temperatures - 35-45° F.) are killed by ordinary pasteurization temperatures; therefore, their presence in dairy products as a factor of spoilage indicates that they gained entrance to the product following pasteurization.

Research workers have been focusing more attention on this group of bacteria, pointing out their presence as a guide to properly sanitized equipment and post-pasteurization contamination as well as their importance in the

deterioration of fresh milk, cottage cheese, butter, cheddar cheese, and fresh concentrated milk. This group of organisms has been known for many years but has not received proper attention until recent years. Olson, Parker, and Mueller (14) have reported that the effect of psychrophiles on the flavor of fresh milk does not manifest itself for 3 or 4 days of storage and often for longer periods. Consideration, of course, must be given to the number of organisms and the types present.

In butter the presence of Pseudomonas Putrefaciens (15) has been responsible for the development of "surface taint" which, in its pronounced stages, appears in about 10 days. As a forerunner to the advanced flavor development, there may be other minor flavor defects not readily identified. Other species of Pseudomonas and Achromabacter may be found in rancid and cheesy butter.

Psychrophilic types are responsible for heavy losses in cottage cheese through the formation of an opaque gelatinous type curd, sometimes referred to as "tapioca" curd, or through direct flavor defects such as fruity, bitter, and unclean or utensil. Cottage cheese, as with butter, may be contaminated by these organisms through infected wash water. They can be controlled to some extent in cottage cheese by controlling the pH to 4.8 or below. They grow very well at pH of about 5.1 to 5.2 a point, quite common in modern sweet curd creamed cottage cheese.

Their influence is not so noticeable in cheddar cheese because the pH is usually at the lower levels. In instances of heavy contamination, however, they will come in for their share of credit for flavor defects, especially when the cheese is cured at low temperatures and the salt content is less than 1.6 percent.

The keeping quality of fresh concentrated milk is greatly influenced by psychrophiles. According to studies reported (16), psychrophilic growth takes place at an appreciably greater rate in recombined milk than in the concentrate from which it was prepared. In general it may be said that the problem and its control in concentrated milk are similar to that of fresh milk. Requirements for control of psychrophiles, then, may be summarized as follows: (1) Proper pasteurization; (2) proper cleaning and sanitizing of all equipment, particularly that used following pasteurization; (3) protection of properly cleaned and sanitized equipment prior to use; (4) chlorination or other bactericidal treatment of water supplies, especially those used in the manufacture of cottage cheese and butter (usually 5-10 p.p.m. of chlorine is sufficient).

In mentioning the detrimental effect of some wash water containing psychrophilic and other harmful bacteria and certain recommended bactericidal procedures, it might be reported here that a new group of bactericides, known as iodophors, are being developed and used successfully. Iodine and bromide compounds have been successfully altered to produce effective yet safe results.

Iodophor Detergent Sanitizers. The germicidal property of elemental iodine and a surface active agent to form an iodophor is a rather recent development. Terry and Shelanski (17), Lazarus (18), Johns (19), and Mueller (20) have reported favorably on the germicidal properties of the iodophors.

Acid-buffered iodine-iodide solutions and available marketed preparations of iodophors are effective as sanitizing agents in concentrations from 25 to 75 p.p.m. of free iodine and even concentrations as low as 10 to 12.5 p.p.m., the exact concentration depending upon the specific practical application (21).

Lazarus (22) reported the following with respect to certain iodophors:

1. There is no corrosive effect on metals, rubber, and plastics.
2. The salts commonly associated with the development of milkstone are solubilized and act as a preventive of stone formation.
3. There is no perceptible odor, flavor, or taste in use-dilution solutions on butter, cheese, and milk and cream.
4. There is no inhibition caused to lactic acid development.
5. Toxicity, sensitivity, and irritation tests meet Food and Drug requirements.

These iodine solutions show promise as sanitizing agents for suitable dairy plant equipment and treatment of wash water; however, we should keep in mind that they are not to be used as an excuse for careless and unsanitary methods in operation.

Cleaned-in-place Installations. In our drive for improved sanitation and at the same time to reduce cleaning costs to a minimum, "cleaned-in-place" installations of pipelines in plants have been making rapid strides. This term refers to the cleaning and sanitizing of dairy processing equipment and piping in its assembled conditions, and applies to the cleaning of pipeline milkers and installations at the farm level as well as at the plant. The results obtained from most installations have been reported as superior to the old conventional method of disassembly and washing, when strict routines were followed regarding proper installation and standardized cleaning practices. Seiberling (23) of Ohio State University outlines the following steps necessary in developing a C-I-P program: (1) Developing the circuit, (2) selecting the materials, (3) completing the installations, and (4) planning a cleaning program capable of producing the desired results. He also points out that the general operation of a C-I-P system involves the following procedure: (1) Flush system free from product residues; (2) clean valves, caps, and other manually cleaned items, install bypasses and connect return lines to complete the circuit; (3) wash by recirculating acid or alkaline detergents under conditions of time and temperature which will produce the desired results; (4) rinse and cool the system, then drain completely; and (5) reassemble for processing and sanitize with hot water or chemical sanitizers.

Like most new developments which are adopted because of certain advantages, certain disadvantages must be recognized and considered regarding their use. As reported by Smith and Roth of Wyandotte Chemical Corporation (24), cleaning equipment in place by mechanical means creates a problem of corrosion. It is necessary to prevent the flow of electric current from one piece of metal to another or from one spot to another on the same piece of equipment. It is important that all metal in any C-I-P circuit be of the same type, and all motors, liquid level controls, and other electrical equipment be grounded away from stainless steel.

Packaging and Packing of Butter. During the past few years we have encountered some difficulty with respect to mold and surface oxidized flavor of butter, which in many cases were caused by faulty boxes or lack of adequate treatment of the liners.

Containers used for bulk butter should be sound with inside surface, including flaps, properly waxed to protect the contents satisfactorily through regular channels of trade and storage. The parchment liners should be of sufficient width and length and so placed in the boxes so that all surfaces of the butter are completely covered. Due to the importance of proper treatment of parchment liners in the bulk butter package for protection against mold and other possible deterioration, the liners should be treated as follows: Completely immerse them in a salt solution in a suitable noncorrosive container, hold them therein at the boiling point for at least 30 minutes, and continue to hold in this solution until ready for use. They should not be rinsed in tap water before they are used, for to do so would nullify the effectiveness of the hot brine treatment. The solution should consist of at least 15 pounds of salt for every 100 pounds of water, and should be changed at least several times a week. The lined butter boxes should be inverted until ready for use to afford protection from possible contamination. The staples used in the construction of the butter boxes should be rust-resistant in order to prevent partial discoloration of the liners and surface of the butter. The butter boxes should be adequately sealed.

The butter should be firmly and uniformly packed in the boxes and the top surface smoothed to prevent air pockets and thus reduce possible surface deterioration.

Today much of the bulk butter is repackaged into consumer size units by the use of automatic printing machines. It is extremely important that all printing operations be maintained in a clean and sanitary condition. Most of the print butter is packaged four quarters to the pound and cartoned, and the rest is printed mainly into one-half and one-pound units or patties. Very recently we have witnessed the packaging of sliced butter in half-pound units (two quarters of sliced butter), parchment wrapped with a wax outer wrapper.

The quality and kind of packaging materials have a direct bearing on the shelf life of the butter. The following abstract appeared in the March 1952 issue of the Journal of Dairy Science:

> "Quality of vegetable parchment wrappers in relation to the quality of butter. W. R. Mummery, F. H. McDowell and A.K.R. McDowell, Dairy Research Inst., Palmerston North, New Zealand. New Zealand J. Sci. Technol., 32A 3:1-14 Oct., 1950.
>
> "Investigations of the cause of off-flavor in butter due to a parchment paper indicated that a high content of copper and iron might be responsible for a part of the defective flavor. Parchment papers containing more than 3 p.p.m. of soluble copper or 6 p.p.m. of soluble iron were likely to cause off-flavors in butter."

This study corroborates the findings of Turgesen (25) on the influence of copper and iron in parchment butter wrappers to the keeping quality of butter.

While a large proportion of the print butter today is parchment wrapped and cartoned, many distributors of butter are using parchment paper laminated to aluminum foil or waxed parchment. This type of wrapping material, while somewhat higher in cost, has been successful in reducing or eliminating surface oxidized flavor. This finding was also borne out by the work done by Turgesen (25) as mentioned above.

Spreadability of Butter. At the present time much attention is being directed toward the need of improving the body and texture of butter and hence the spreadability of the product. When we consider that butter is used mainly as a spread and spreadability is of major importance to consumers, this problem looms large.

Coulter (26) urges that those responsible for the management of our butter operations take a more active interest in the body characteristics of the butter they manufacture or sell. He points out that by manipulation of manufacturing procedures, butter which is smooth and waxy in body and reasonably spreadable can be made even from the hard fat of winter cream. These manipulations included:

1. Adjustment of the rate and extent of cooling of the cream.
2. Adjustment of the rate and extent at which the butter is chilled.
3. Avoiding unnecessary and excessive fluctuation in the temperature of the butter.

Thomsen (27) reports that when an effort is made to relate the treatment of the cream or of the butter to spreadability, a formidable list of variables is encountered. He enumerates the following:

1. Ability to develop positive methods for measuring spreadability so that it will correspond with the consumer's conception.
2. The composition of butterfat as a factor in developing desirable spreadability.
3. The size and physical make-up of fat globules insofar as they are influenced by breed, period of lactation, season, and treatment of the cream.
4. The richness of the cream.
5. Cream treatment, including separation, temperature, and treatment (including time) to the time of churning.
6. Churning temperature and temperature treatment during churning.
7. Size of granules to which churned.
8. Temperature treatment of butter in the churn, from the granular form to the completed butter.
9. Amount and method of salting.
10. Amount and method of working.
11. Composition of the butter.
12. Alternate procedure for converting cream to butter.
13. Special products, such as plastic cream, frozen cream, and whey cream butter.

14. The use of special additives to butter.
15. Treatment of the butter subsequent to work up to and including the final package.
16. Consumer handling.

We can see from the foregoing that there are many variables in obtaining our objective of good spreadability. These conditions are not insurmountable if careful attention is given to those factors which, we know through research, have a bearing upon the problem.

Packaging of Cheddar Cheese. Improving the packaging of cheddar cheese is one area in which increased stress would add many dollars to the incomes of the industry by reducing losses that occur from poor finish on paraffin-dipped cheese, as will be pointed out later. The trend toward rindless block cheese has helped to overcome some problems, and certain aspects of that technique will be discussed later. There is still a very high percentage of cheese in the industry packaged in the conventional bandage and paraffin-dipped manner. For that reason we will try to point out some of the problems involved and observations made as a result of reports from the Inspection and Grading Branch of the Dairy Division, U. S. Department of Agriculture, on cheese graded and stored under the price support program, as well as that observed in commercial channels of trade.

Finish, which concerns the shape or conformation and the surface characteristics without regard to the interior quality of the cheese, is of utmost importance in the marketing as well as shelf life of the cheddar cheese. The bonding of a petroleum product such as paraffin wax, which is incompatible with moisture, onto the surface of a product which is over one-third moisture, presents a problem with which the industry has been struggling for many years. Blistered paraffin and mold under the paraffin, for the most part, result from a failure to provide a firm dry rind on the surface of the cheese before dipping. The proper finish on the cheese starts at the hooping and pressing stage of the process.

Developing a uniformly shaped cheese, with a firm, smooth, sound rind, with sufficient drying on all surfaces of the cheese prior to dipping is a prerequisite in forming a satisfactory bond with the paraffin. In addition, the temperature of the paraffin at dipping, as well as the grade, melting point, and the length of time submerged, all have direct bearing upon the character of the finished surface.

In our eternal drive to shorten the "make" period and get the work done in the shortest possible time, short cuts are often taken which ultimately result in unattractive, moldy surfaced cheese, contributing to heavy cleaning losses and direct loss from mold in the interior of the cheese.

The box or container in which the cheese is packaged and stored can contribute much to the way in which the cheese will reach the market. Wooden boxes made from green lumber, or which have been allowed to get wet or have been stored in a damp place, are often responsible for the start of surface mold. An unsound surface can quickly develop into mold under the paraffin,

with greatly increased losses. Used boxes which have not been properly cleaned and reconditioned also may infect new cheese with mold and cheese mites. All these conditions could be avoided by proper precautions.

The strength and construction of the box, whether wood or fiber, are more important than is sometimes realized. Quite often a few pennies saved in using a cheaper, poorly constructed box will mean dollars lost by someone when the box will not stand the numerous handlings and pressure of stacking in warehouses and storage rooms. The box at all times should protect the individual cheese from outward pressures of handling and stacking and be free from obstructions, such as nails, splinters, etc., which might damage or puncture the surface of the cheese.

It is surprising to note how often scaleboards are omitted from the top and bottom of the cheese as well as between one or more cheeses in a box. Scaleboards afford a great deal of protection to the cheese in absorbing moisture or preventing two cheeses from sticking together.

The packaging of rindless block cheese is still in a developmental stage. Since its early beginning about 15 years ago many methods and many new covering materials have been developed with varying success. The basic idea is sound in that the technique is intended to reduce waste by eliminating rind formation and surface deterioration and evaporation. This end is usually accomplished whenever the material used prevents the formation of mold under the covering, which is the biggest problem. A tight impervious seal is necessary both at the seams or overlaps and also by the covering itself.

Several types of covering or wraps, developed by various firms, can be generally classified as plastic film type and foil type. In the plastic film group some packaging is being done on small packages using the vacuum pack.

Regardless of the type of covering used, the development of mold under the covering has continued to be a problem with this method of packaging. In spite of the strictest sanitary measures to avoid mold contamination of the cheese during packaging, a certain portion contains spores or becomes contaminated. Sanitizing lamps have been helpful but are not the entire solution.

Various antimycotic substances, such as sorbic acid and proprionates have been used both on the surface of the cheese and on the wrapper. Dehydroacetic acid also was tried as an application to the covering but was found to enter the cheese in substantial amounts, and action was taken by the Food and Drug Administration prohibiting its use. More recently dimethyl dichlorosuccinate (28) has been used experimentally as a film on the wrapper, but its toxicity is still being questioned. A product known as "Scorbic," presumably using sorbic acid as a film coating material, is now available. The manufacturer claims the product will markedly reduce mold growth on the surface of the cheese.

It should be pointed out here that a number of these compounds are patented, and their use therefore may be restricted. More important is the

fact that their use is restricted to a special permit basis by the Food and Drug Administration. At present only two compounds--namely, the proprionates and sorbic acid--are temporarily approved on a special permit basis in the packaging of cheese. This policy is being followed by Food and Drug Administration until such time as it can be conclusively shown that there is no toxic effect from their use.

Some Quality Factors Related to Storage of Butter

Changes occurring during the storage of butter lead to various defects which mainly affect the flavor. Chemical changes can proceed at all storage temperatures even in deep freeze. However, extremely low temperatures (-10° F.) slow down the oxidation processes. Holm and others (29) found that butter kept best at -10° F., but reported that a drop in temperatures from -10° to -17° F. did not result in an increase in keeping quality proportionate to that observed by a similar lowering at a higher temperature range.

All too frequently we encounter metallic, oily, and fishy flavors in storage butter. If these are to be kept to a minimum, the creamery operators should (1) eliminate or correct producer cans that are rusty, (2) process the cream in equipment that will not contribute to copper and iron contamination, (3) keep can steamings out of top grade, (4) neutralize the cream to pH values of 6.7 to 7.2, and (5) salt the butter to a level of about 2.0 percent.

Copper and iron contamination accelerates oxidation even in very small amounts. In general it is agreed that butter containing less than 0.2 p.p.m. copper and 2.0 p.p.m. iron will have minimum keeping quality so far as metallic contamination is concerned. Barnicoat (30), a New Zealand worker, reports that the presence of 0.50 p.p.m. iron or copper lowered the grade score of butter compared with the controls when the examination was made a few days after manufacture. Iron was more powerful as a catalyst of oxidation of sweet cream butter (at a pH about 6.7), but in butter with lower pH made from slightly ripened cream, copper was more active. His studies further show that the pH of butter after manufacture (or cream acidity at churning) was the most important factor influencing loss in grade score for flavor of butter during storage through catalytic oxidation of the butterfat. In butters below pH 6.6 copper was approximately five times as active as iron in promoting losses in grade score for flavor.

Research work over the years has indicated that the churning acidity of the cream, and therefore the acidity of the butter serum, is one of the most important factors affecting both the initial and keeping quality of butter flavor. Bird (31) found that there was a fairly close relation between the pH of butter serum and some common flavor defects of storage butter. At pH values below 6.6 metallic flavors became important, while fishy flavors commonly developed at pH values of 6.0 or lower. Hussong, Quam, and Hammer (32) also have observed that fishy flavors are at pH values of 6.0 or lower, or when these flavors developed at higher pH values, the butter usually contained relatively high copper contents.

One of the most troublesome and costly flavor defects encountered in fresh and storage butter is "surface taint" (protein decomposition), which defect is largely caused by the organism Pseudomonas Putrefaciens.

Most investigators are in agreement that the following control measures are important:

1. Purification of water supplies.
2. Sanitizing of equipment, wooden churns being a common source of contamination.
3. Adequate pasteurization temperatures.
4. Adequate working to produce a firm, waxy body. Leaky butter is more vulnerable to protein decomposition.
5. Increased salt content, 2.0 to 2.25 percent is adequate under most conditions.
6. Higher acidities at churning (about 0.15 percent pH of 6.7-6.9, most desirable).

Pont (33) indicated that within the range of safe limits from the standpoint of chemical changes, in butter, high acidities aid in minimizing the surface taint defect.

In the work of Itzerott, (34) cream acidities below 0.15 percent had little effect on the time required for development of the surface taint flavor in butter. Above 0.15 percent acidity, however, appeared to have a retarding influence. High acidities in conjunction with low temperatures definitely inhibited the defect.

Macy (35) reported that low acidity in the butter is unquestionably an influencing factor in the appearance of surface taint and many other putrefactive change related to it.

For good keeping quality the cream for butter making should be pasteurized to a temperature of not less than 165° F. for at least 30 minutes for the holding method or not less than 185° F. for at least 15 seconds for the flash methods.

The retarding effect of salt on the activity of bacteria in butter is generally recognized. The important factors influencing the action of salt in butter appear to be concentration in the water and uniformity of distribution throughout the water droplets.

Claydon and Hammer (36) concluded that salt is not entirely effective in inhibiting the surface taint defect in butter unless combined with thorough working of the butter. They reported that when butter containing a pure culture of Ps. putrefaciens was worked only slightly, neither 1 nor 2 percent salt prevented the defect. With thorough working either amount controlled it.

In many cases the development of surface taint in butter has been caused by a contaminated water supply containing Ps. putrefaciens. It is therefore extremely important that water samples should be analyzed for proteolytic bacteria.

Macy (35) pointed out that outbreaks, in Minnesota butter, of a defect resembling surface taint were in nearly every case traced to an infected water supply. The difficulty was overcome by seeking a new source of water or by resorting to the treatment of the water at hand.

Ps. putrefaciens has been observed by Hammer (37) from water used to wash butter. These isolations were made in connection with studies on creameries having difficulty with butter deterioration.

Long and Corley (38) frequently noted that water collected directly from a creamery well was satisfactory, while that collected at the churn was unsatisfactory. They concluded that in these instances the contamination evidently occurred either in the storage tank or in the piping.

In a later publication Corley et al. (39) reported on a detailed investigation of the water supply of 70 Iowa creameries over a period of 18 months. These investigations observed that some supplies regularly were satisfactory and some regularly were unsatisfactory, while others varied in quality from one examination to another. Ps. putrefaciens was isolated from approximately 5 percent of the water samples examined. They concluded that various water supplies, acceptable from a public health standpoint, were not suitable for use in butter manufacture because of the presence of certain organisms causing spoilage in butter.

Some Quality Factors Related to Storage of Cheese

The storing or curing of cheddar cheese, which may be considered to be the second phase of its manufacture, also is affected by time and temperature. Relative humidity is important, but it will not be dealt with at this time. The factors of time and temperature, however, are so closely related to the inherent character and quality of the cheese prior to curing that we cannot discuss their effects without considering the factors of composition which have a direct bearing on the quality.

The importance of the quality of the raw material, as well as the sanitation and careful manufacturing methods, have already been discussed. However, at this particular point we may consider composition, particularly with reference to moisture and salt content, as having a great influence on the length of time and the temperature at which cheese may be held in storage.

As you know, Federal laws set the upper limit on the moisture content of cheddar cheese at 39 percent. Therefore, for the sake of increased yield, the moisture content of much of our current cheese will be close to that figure. This requirement does not mean, however, that in all instances cheese containing 39 percent moisture will be of maximum high quality. Quite the contrary. In instances where the quality of the milk is not the best, cheese made from it with a lower moisture content is more desirable. Since there is an increase in breakdown with the higher moisture content, all other factors being equal, cheese intended for longer curing periods should be adjusted downward on moisture content. Too often this adjustment is not made, and the cheese is held in

storage beyond its maximum quality period. Too little attention is being given at the time cheese is made to the length of time that it may be held before marketing. From a quality standpoint, therefore, it is safer to make a lower moisture cheese so that it will retain its maximum quality until the market is available.

Closely allied to the moisture content and the curing period is the salt content. Again some of our methods have been rather haphazard, without much regard to standardizing the salt content in relation to the moisture. Salt has certain beneficial effects upon the body, texture, and flavor of the cheese, as well as an inhibitive effect upon certain bacteriological activity, which of course affects the flavor. The inhibiting effect is in direct relation to the concentration of the salt in the moisture of the cheese and may not be governed by the total salt percentage. In other words, two cheeses with the same percentage salt content, but with widely different moisture content, would cure entirely differently due to the difference in the concentration of the salt in the moisture. To maintain the same concentration, then, a lower moisture cheese requires less salt than a higher moisture cheese. This fact is often overlooked in figuring the salt requirements of a cheese at salting time, and the result is likely to be a tough corky cheese which will not cure satisfactorily or which must be held in storage much longer than is economical.

A cheese with a low salt content will have a flat flavor and be weak-bodied and pasty, whereas too high a salt content will inhibit proper bacterial growth, delay curing, and is apt to be coarse and corky. Therefore there is an optimum salt content for the best quality of every vat of cheese. Riddet et al. (40), in New Zealand, found that cheese of normal body contained on the average 1.66 percent salt, or the equivalent of 4.82 percent salt in the moisture of the cheese. This percentage amounted to 2.25 pounds of salt per 100 pounds of curd. The rate per 100 pounds of curd or per 1,000 pounds of milk, however, will depend on the grade of salt, time and manner of salting, moisture content of cheese at salting time, and other factors. In a survey of Canadian cheese made by the Ontario Agricultural College in 1954, Irvine (41) reports that as the salt in the moisture increased from 3.33 percent to 5.33 percent, the proportion of cheese with premium scores increased and the proportion of undergrades decreased. He concluded that cheese having between 4.66 and 5.33 percent salt in the moisture had the best chance of receiving high scores.

Because of the variable factors that may widely affect the amount of salt which may be incorporated into the cheese, more analyses should be run by the factories to determine the salt content of each vat. Only in this way can cheese of suitable quality and uniformity be cured.

The effects of metallic compounds on the flavor of other dairy products have already been mentioned. We could not leave the subject of storing cheese without some mention of metallic salts on the flavor of cheese. Stine, Loos, and Daume in 1949 (42) reported that cheese with as little as 0.166 p.p.m. of Cu in the milk and a resulting content of 2.2 p.p.m. in the cheese resulted in a metallic flavor. They concluded from their studies that:

1. The copper content of cheddar cheese made on stainless steel equipment may vary from 0.5 to 1.4 p.p.m.
2. The copper content of cheddar cheese having been made on tinned copper ranges from 0.5 p.p.m. up, depending on the amount of exposed copper. Samples having as much as 33.8 p.p.m. of copper were found.
3. On cheddar cheese having a copper content of 2 p.p.m. or over the development of a typical cheddar cheese flavor will be prevented or greatly retarded, and in most instances a pronounced metallic or oxidized flavor will be noted when the cheese is cured for as much as 2 or 3 months.
4. From the data observed, the presence of 2 p.p.m. of copper in cheese results in a metallic or oxidized flavor.
5. From the data observed with the presence of over 2 p.p.m. of copper, the cheese food is found to be dull or grayish in appearance when regular annatto cheese color is used.
6. The copper content in the milk is largely concentrated in the cheese made from the milk, with only a small fraction of the copper remaining in the whey. Usually cheese contains 7 to 10 times as much copper as the milk from which it was made.

Mention has already been made of the importance of a good finish or surface in marketability, but it may again be emphasized that a good finish is imperative to storage and curing of cheese if heavy losses are to be avoided.

On the basis of an estimate made on Canadian cheese in 1952-1953 (43), 15 percent of the cheese originally grading Canadian First Grade was graded down after storage due to defective rind development.

In 1951, a summary of regrading of cheddar cheese purchased by the U. S. Department of Agriculture was made (44) in which it was reported that 24.1 percent of the U. S. Grade A cheese purchased was downgraded at least one grade, approximately half of which was because of finish defects. The principal reasons were: Mold under paraffin, scaly, blistered, and checked paraffin.

These findings closely correlate the situation as reported in Canada. Although this report is now over 4 years old, there is little reason to believe that the situation has materially improved except that the percentage of rindless cheese has increased since that time. We need to keep in mind also that this report covers only U. S. Grade A cheese purchased by the Government, on which the finish is reasonably good at the time of grading, and does not include the high percentage of cheese which was not accepted because of poor finish at the time of grading.

General Comments

The wide scope of the title of this paper and the complex nature of the subject material has made it impossible to touch on all factors which contribute to maintaining the quality of dairy products. Only some of the more important ones have been brought to your attention here in an effort to highlight

their importance. The results of research findings which become buried in literature which are not acted upon by those responsible for the production and marketing of our dairy products cannot possibly bring about improvement.

In conclusion, then, we would say that we need to operate closer to the findings which are consistently being pointed out to us in research studies and to put these findings into practice.

Literature Cited

1. Krienke, W. A. Penicillin in Milk. Milk Plant Monthly, 38, 12, 44. December 1949.

2. Baker, D. T. The Control of Mastitis—Use of Antibiotics and Their Effects on Milk Quality. Milk Industry Foundation, 47th Annual Convention, Milk Supplies Section, Atlantic City, New Jersey. October 1954.

3. Federal Security Agency, Administrator. Direct or Indirect Addition of Antibiotic Drugs to Foods for Human Consumption. Federal Register, Feb. 25, 1953.

4. Herrington, B. L. Lipase: A Review J. Dairy Science 37: 775. 1954.

5. Kelley, L. A. and Dunkley, W. L. Hydrolytic Rancidity Induced by Pipeline Milkers. Journal Milk and Food Tech.

6. Supplee, G. C. and Bellis, B. The Copper Content of Cow's Milk, Journal of Dairy Science. 5: 455. 1922.

7. Giroux, L. R., Bryand and Sproule, W. H. Effect of Quality of Dairy Products. Canadian Dairy and Ice Cream Journal. January 1955.

8. McDowell, A. K. R. The Estimation of Copper and Iron in Cream, Butter, and Dry Butterfat. Journal of Dairy Research. 15:70. 1947.

9. Julien, J. P. and Martin, G. Effect of Iron Content on Quality of Quebec Butter. Canadian Dairy and Ice Cream Journal. 31:7, 36. 1952.

10. Mitten, M. L. Corrosion of Dairy Metals. American Milk Review. 16:50, February 1954.

11. Pont, E. G. The Washing of Butter and Its Effect on Curd Content. Australia Scientific and Industrial Research Journal. 19 (4) 432, November 1946.

12. Pont, E. G. The Keeping Quality of Unwashed Butter. Australia Scientific and Industrial Research Journal. 21(4) 319, November 1948.

13. White, H. and Riel, R. R. Studies on Non-Washing on Butter. Paper presented at 50th Annual Meeting, American Dairy Science Association, East Lansing, Michigan. June 20, 1955.

14. Olson, J. C., Parker, R. B., Mueller, W. S. Nature Significance and Control of Psychrophilic Bacteria in Dairy Products. J. Milk and Food Tech. Vol. 18; 8 p. 200. August 1955.

15. Wagenaar, R. O., The Bacteriology of Surface Taint Butter, A Review. J. Dairy Science 35:403-423. 1952.

16. Olson, J. C., Jr., Nielson, A. J., Thomas, E. L., Morris, H. A. Changes in Bacterial Counts and Flavor of Concentrated and Recombined Milks During Storage at Low Temperatures. J. Dairy Science 36:817-824. 1953.

17. Terry, D. H. and Shelanski, H. Iodine as a Germicide. Part One. Modern Sanitation 4:(1) 61-55. 1952.

18. Lazarus, N. E. New Development in Detergent-Sanitizers. Milk Dealer, 42:(1) 45, 68-71. 1952.

19. Johns, C. K. Iodophors as Sanitizing Agents. Canadian Journal of Technology; 32: 71-77. 1954.

20. Mueller, W. S. Bactericidal Effectiveness of Iodophor Detergent Sanitizers. Journal of Milk and Food Technology. 18(6) 144-146 and 149. June 1955.

21. Gershenfeld, Louis. Iodine and Sanitation. Journal of Milk and Food Technology. 18(9) 220-225. September 1955.

22. Lazarus, N. E. A New Development in Dairy Plant Sanitation. Southern Dairy Products Journal. 58(1) 32, 76-79 and 83. July 1955.

23. Seiberling, D. A. Engineering for C-I-P. Milk Plant Monthly 44: 8; 13 1955.

24. Smith, G. A., Roth, A. A. Plant Equipment Cleaned-In-Place. Milk Plant Monthly 44, 8: 27. 1955.

25. Turgasen, V. L. A Surface Defect of Print Butter Related to Parchment Wrapper. A paper presented to the Dairy Products Institute, University of Minnesota. September 20, 1948.

26. Coulter, S. T. Spreadability of Butter. Paper presented at the University of Minnesota, Dairy Products Institute in St. Paul, Minn. Sept. 21, 1955.

27. Thomsen, L. C. Effect of Variations in the Manufacturing Process on Body and Texture of Butter with Special Emphasis on Spreadability. Paper presented at the University of Minnesota, Dairy Products Institute in St. Paul, Minn. Sept. 21, 1955.

28. Mottern, H. H. Cheese Keeps Longer in Antimycotic Wrapper. Food Engineering Vol. 26, 10 p. 93. October 1954.

29. Holm, G. E., Wright, D. A., White, W., and Deysher, E. F. Journal of Dairy Science, 21: 385. 1938.

30. Barnicoat, C. R. Experiments on the Packing and Storage of Butter. J. Science and Tech. (N.Z.) Vol. 32 No. 2:11. August 1950.

31. Bird, E. W. Effect of Variation in Churning Acidity on the Manufacture of Butter. National Cheese and Butter Journal 30: 1:16. 1939.

32. Hussong, R. V., Quam, Sidney, and Hammer, B. W. Observations on Fishiness in Butter. Journal of Dairy Science. 21:7. 1938.

33. Pont, E. G. The Rabbito Defect of Butter. Australia Scientific and Industrial Research Journal. 14:1-10. 1941.

34. Itzerett, A. G. F. The Rabbito Defect in Butter. Journal Dept. of Agri., Victoria 39, 39-42. 1941.

35. Macy, H. A Discussion of Some Current Defects in Butter. Canadian Dairy and Ice Cream Journal. 11(4): 34, 36, 46-47. 1932.

36. Cladon, T. J. and Hammer, B. W. Bacteriology of Butter. VIII. Relationship of Achromobacter Putrefaciens to the Putrid Defect of Butter. Iowa Agri. Exp. Sta. Res. Bul. 267. 1939.

37. Hammer, B. W. Bacteriological Defects of Butter. Dairy Produce, 46(3): 9-10. 1939.

38. Long, H. F. and Corley, R. T. Observations on Bacteriological Condition of Creamery Water Supplies (Abs.). Journal of Bacteriology 44: 255. 1942.

39. Corley, R. T., Long, H. F., and Hammer, B. W. Water Supplies of Butter Manufacturing Plant. Iowa Research Bulletin 319, May 1943.

40. Riddet, W., Valentine, O. M. and McDowall, F. H. and Whelan, L. A. The Effect of Salt on the Quality of Cheddar Cheese. New Zealand Dept. of Sci. and Ind. Res. Bul. 37. 1933.

41. Irvine, O. R. Salting Cheddar Cheese. Canadian Dairy and Ice Cream Journal Vol. 34: No. 3. March 1955.

42. Stine, J. Bryan, Loos, Henry, Daume, H. E. The Effect of Copper on the Quality of Cheddar Cheese and Cheese Foods. Proc. XIIth Int. Dairy Congress Vol. 2 Sec. 2 p. 350-353. 1949.

43. Irvine, O. R., Bullock, D. H., Edmond, R. E. Paraffin and Mecrocrystalline Waxes as Cheese Coating Materials. Canadian J. Agr. Sci. Vol. 35 No. 2. March-April 1955.

44. Regradings of Cheddar Cheese Purchased and Stored Under 1949-50 Milk and Butterfat Price Support Programs. U. S. Dept. of Agri.-PMA. Mimeo 5 P. April 1951.

RECOMMENDATIONS OF WORK GROUP

H. J. Weavers, Wisconsin, Chairman
J. C. White, Colorado, Secretary

Because of the general agreement in this work group that the maintenance of quality in dairy products is most important, the following conclusions have been drawn.

1. There is a need to develop statewide or areawide programs to integrate plants and companies into organized programs of dairy quality improvement.

2. Because regulatory officials sometimes are not aware of the problems of market development, an effort should be made to integrate these functions at the State or local level.

3. It is difficult or impossible to produce high-quality manufactured dairy products from low-grade raw materials. Much of the poor quality of milk and cream results from poor farm practices, farm management, and/or production methods. Every effort should be made to make research results and information available to all milk and cream producers.

4. There is a need to encourage personnel in our dairy plants to study and use recent research findings and to keep abreast of current developments in dairy quality production in order to provide adequate quality control facilities for their operation.

5. The merits of a possible marketwide controlled marketing order should be explored--orders which would control not only the economics of dairy commodities, including milk and cream, but also their quality and grade.

MAINTAINING THE QUALITY OF GRAIN AND OILSEEDS

RESEARCH TO MAINTAIN GRAIN QUALITY

William C. Dachtler, Market Organization and Costs Branch,
Marketing Research Division, Agricultural Marketing
Service, U.S.D.A.

The subject of this work session is one that has received a great deal of attention in the last year or two. Interest in grain quality is of long standing, but now there is the added incentive provided by the intensified program

of the Food and Drug Administration. As long as grain could be marketed even though the price were discounted slightly, little attention was paid to the improvement of quality. Now with the ever-present threat that grain may not be salable at all in the market or may be diverted to secondary uses at substantially lower prices, the thirst for knowledge of ways to improve quality has been heightened. It's the old story of the need for prodding to get around to doing those things we all recognize as desirable but we seldom seem to quite get done.

The area of grain quality is so extensive that I believe we need to restrict it somewhat for the purpose of our discussion today. The program planned for this session places emphasis on a clean grain program. Therefore we will not be concerned here with grain quality as related to specific end uses for grain, e.g. protein quality, gluten quality, starch quality, etc., but rather quality from the standpoint of soundness of the grain--freedom from damage or contamination by insects, rodents, foreign material, molds, and similar factors. As a further limitation I suggest we consider the problems of maintaining grain quality after the grain has been harvested--during storage, handling, and conditioning both on farms and in market channels.

Many of the Department's research activities which are related to grain quality in the sense we are using the term now are centered in the Marketing Research Division of the Agricultural Marketing Service. The entomologists, engineers, economists, commodity specialists, and others who make up the staff of this group have been working for a number of years on problems relating to grain storage and handling. Procedures have been developed for controlling insect infestations in stored grain by (1) direct insecticidal practices and (2) the conditioning of the grain itself. The engineers also have designed and developed storage structures which are weather-, rodent-, and bird-proof, as well as equipment and techniques for aerating grain to minimize the effects of temperature and moisture change. Effective control measures have been developed, such as fumigation, good housekeeping practices for the cleanup of storage bins and the elimination of local sources of infestation, based on a thorough knowledge of the insects involved and their habits, as well as the relation between grain condition and insect infestation.

The current research program is directed toward improvements in these now more or less standard procedures and toward new procedures necessitated by changes in grain handling practices and by the change to storing grain for 2, 3, or even 5 years, instead of from harvest to harvest. Increased emphasis also is being placed on procedures for preventing insect attack, moisture accumulation, and temperature increases. It is no longer sufficient to rely on measures for control after trouble occurs. The objectives of research must be three-fold--prevention, detection, and control.

Early in 1952 our research program was modified to put more emphasis on better grain sanitation. A Department Committee on Insect and Rodent Damaged Grain prepared and sponsored literature on grain sanitation known as the IAFS series, which was released by the Departments of Agriculture and Interior and the Federal Security Agency. The Marketing Research Division also is carrying out considerable research sponsored by the Commodity Credit Corporation for use

in the bin-storage program. The problem that CCC is facing in relation to maintaining the quality and cleanliness of its bin stocks has been a primary factor in this cooperative research. Two recent developments are (1) the revision of procedures for use at CCC bin sites to incorporate improved methods developed through research and (2) the operation of an experimental bin site where the improved storage procedures are being developed. The adoption of effective procedures at bin sites also has influenced producers in the locality in the methods they apply on their own farms.

Current research efforts are directed toward:

1. Improving fumigation procedures to permit more efficient and less costly treatments of bulk grain. The fumigation of bulk grain by recirculating the fumigant through it, utilizing existing grain aeration systems, is an example.

2. Developing protective sprays or dusts for grain, and the determination of safe residue levels and permissible tolerances under the Miller Bill. Formulations containing pyrethrum as the active ingredient are already on the market and are being used to a considerable degree.

3. Exploring the possibilities of electrical energy treatments for grain, such as with high frequency radio waves (induction heating), cathode-ray irradiation, gamma-ray irradiation, and similar processes. None of these is ready for commercial use owing to lack of suitable equipment by which grain can be treated as a continuous process in amounts that will be economical, but all new developments are being observed.

4. Development of simple methods to detect hidden infestation that can be used by the grain handler.

5. Development of improved storage structures to prevent damage by penetration of moisture, birds, and rodents. This is largely a matter of design of floors, exterior walls, roofs, and openings. Moist grain is susceptible to mold damage and provides an excellent environment for insect growth.

6. Development of procedures and equipment to prevent damage resulting from daily and seasonal variations in bulk grain temperatures. As heat is gained and lost by the bulk of grain, temperatures often become high enough to cause deterioration and destructive activity by micro-organisms (molds, etc.) and insects.

7. Appraisals of the efficiency of the alternative techniques and practices developed by entomologists and engineers to determine their feasibility from the standpoint of both cost of the operation and the effectiveness with which the market grade or quality of the grain is maintained.

Let us look more closely at several of the phases of the research we have just listed.

Fumigation of Bulk Grain by the Recirculation Method

Not many years back, the goal in the fumigation of grain was to kill all adult insects present. This was the goal partly because notation on an official grade certificate that the grain was of the special grade, "weevily," was based on the presence of live insects. The fact that is is not easy to determine the mortality of larval forms within the kernels may have been another factor.

In current practices it is important to kill the eggs, larvae, and pupae of weevils, Angoumois grain moth, or other species internally infesting the grain before much development of the insect occurs, for these are the forms, out of all the complex of stored grain insects, that are the source of much of the insect fragment count in flour. The normal dosage rates of common liquid-type grain fumigants would have to be approximately doubled to obtain complete kill of all forms.

In studies to improve the efficiency of fumigation, attention was focused on adapting the recirculation method of application to the fumigation of large bulks of grain. Methyl bromide was selected for the first studies because of a knowledge of its efficiency in fumigation of other commodities.

Methyl bromide has never been very useful as a grain fumigant, since it will not penetrate very far into grain when applied to the surface, although experimental work has demonstrated that when diluted about 1 to 9 with carbon tetrachloride or the standard 75-25 or 80-20 mixtures, it will penetrate very well, but it has not been widely used in this manner.

On the other hand, methyl bromide has proved extremely successful when applied by the recirculation method, in which air drawn from the floor area of the bin, freight car, or storage tank is returned through a gas-tight duct to the head space above the load. When methyl bromide is introduced into such a recirculation cycle, it is drawn through the grain mass and distributed in an even manner. When the fumigation period is ended, the gas can be removed from the grain by the same system through a discharge vent.

Not many opportunities have been available to study this method under practical conditions. It was adapted to the fumigation of cottonseed in large steel tanks holding from 550 to 3,000 tons of seed. It was likewise used in the fumigation of sorghum grain stored in surplus oil tanks.

When the Commodity Credit Corporation stored wheat in Liberty ships in the Hudson and James Rivers in 1953, grain aeration systems were installed in each hold. Permission was obtained to conduct experimental fumigations on these ships, and to alter the aeration systems in selected holds sufficiently to set up a recirculation system. Satisfactory distribution of methyl bromide was obtained in four tests. The bulks of wheat totalled 23,500, 42,000, 41,100 and 40,580 bushels, respectively. The air flow rates in these holds ranged from 0.024 to 0.043 c.f.m./bushel. The gas was removed readily when the aeration system was restored to its original state.

Other tests were made in a commercial grain elevator, where a temporary recirculation system was installed. The system consisted of a perforated pipe placed across the middle of the unloading hopper as an air pick-up source, a 30-inch blower, a flexible-tubing duct up the outside of the 135-foot tank, and a damper arrangement to regulate the air flow rate where the duct reentered the tank through the manhole in the headhouse.

In three tests with shelled corn, satisfactory distribution of methyl bromide was obtained with air flow rates within the range usually used for grain aeration. Gas samples were withdrawn from the bottom, top and 15-, 35-, 55-, 75-, 95-, and 115-foot levels to study the distribution. The gas was removed from the grain within a few hours after each fumigation by diverting the air flow to the outside.

Tests now being made indicate that the standard liquid fumigant mixtures also can be distributed satisfactorily by recirculation, with a possibility of more rapid action and lower application rates.

These tests open up several interesting possibilities:

1. Dual-purpose aeration-recirculation systems will be feasible, where one installation can be used both for grain aeration and cooling, and for recirculation of fumigants.

2. A very high degree of insect kill can be expected because of uniform distribution of the fumigant throughout the grain mass, and there is the possibility of using more volatile fumigants which will penetrate infested kernels more easily. This method should permit spacing fumigations much further apart since refrigeration will take longer to reappear.

3. The cost of fumigation will be materially lowered. It is indicated that the dosage rate for methyl bromide will be 2 pounds or less per 1,000 cubic feet (about 800 bushels of wheat), and for other fumigants will be much lower than with present methods.

4. The safety factor will be increased. The whole process will be conducted in a closed system where the fumigant is applied by opening a valve, and at completion all gas is removed from the grain before the storage structure is opened.

5. The fumigation period will be shortened to 24 hours, and the whole procedure including aeration following fumigation should be completed within 30 hours.

Protective Dusts or Sprays for Grain

The shift in emphasis to the prevention of insect infestation in stored grain has stimulated studies on the direct application of insecticides to grain when it is placed in storage. The usefulness of abrasive dusts such as magnesium oxide, made from mineral sources, has long been known, but such dusts give grain

a gritty feeling and cause downgrading. With the advent of many new insecticides with long-lasting qualities, it appeared possible that some might be adapted to prevention of insect infestation.

This problem is very complex. Not only must the effective dosage rates for various formulations be established for various grains and under various regional conditions, but also it must be determined whether any health hazard exists to the animals or humans who consume products made from grain so treated. Until the present only those insecticides could be used that either broke down or dissipated during the normal storage period, or were removed in the milling process, since the Food, Drug and Cosmetic Act did not permit any insecticide to be present in a food product. Under these circumstances only one insecticide, pyrethrum, has been approved to date for use as a protective dust on grain. However, under the recently enacted Miller Bill, grains are classed as raw agricultural commodities, and it is permissible to use insecticides, where necessary, on such commodities within prescribed tolerance limits. The Miller Bill sets up the machinery by which tolerances can be established.

A number of other insecticides are under study to determine whether they might be used as protective sprays or dusts. Some of these are less expensive than pyrethrum; some last longer. They have been selected because they are so highly effective against insects that only minute amounts which might fall within a low tolerance limit are necessary, or because of their characteristic of being relatively nontoxic to warm-blooded animals at slightly higher dosage rates.

A special committee has been set up jointly by the Agricultural Research Service and the Agricultural Marketing Service to review the research on this subject and the ramifications related to it, and to advise on what ultimate uses should be permitted.

The results obtained to date indicate exciting possibilities in preventing insect infestation in stored grain, particularly under farm-storage and CCC-storage conditions. One formulation applied to farm-stored wheat at harvest in 1952 kept the wheat virtually insect-free over a period of 20 months until the bins were emptied in January 1954. Other formulations applied to CCC-owned corn in September 1952 held infestation to a very low level all through 1953. Approximately two hundred 3,000-bushel bins of corn and wheat have been treated and are being sampled each month to determine the level of insect population. Many of these are going through their second season since treatment.

Most of the bins of grain were treated as they were filled or transferred, by direct application of the dusts or sprays to the grain as it passed through a conveyor. Some loaded bins with aeration systems were treated by drawing an aerosol through the grain while operating the system. The insecticide was deposited on the grain at all levels in the bins by this method.

Detection of Hidden Infestation

The lack of a rapid, simple, and foolproof method for determining hidden infestation has been of great concern. Several methods of detection are now available, such as the cracking and flotation process, the stain technique,

and the X-ray photograph. All of these require considerable time and trained technicians, however, and apparently do not fill the need for a rapid practical detection method.

Three approaches to the separating of infested from noninfested grain are under study, but it should be emphasized that these have not gone beyond the stage of demonstrating that such a separation can be made. None has been simplified to the point where it is ready for use by the grain handler. In each instance the method must yet be incorporated into a gadget that is practically self-operating. These methods are described at this time to show the possible attacks that can be made to solve the detection problem.

One approach is a simplified visual method, using polaroid lenses and an intense light beam. A sample of wheat kernels is placed between two polaroid lenses and the light beam directed through it. By rotating the lenses so that the deepest shade of blue is observed around the edges of the kernels, the shadows formed by the light rays showing through the kernels bring immature insect forms inside them to maximum definition. Although there is not as much visual detail as in the radiographic method, all stages of infestation can be detected.

The second approach is the detection of internal infestation by an electronic device. It has been found that the infrared radiation produced by the metabolism of insect larvae or pupae within kernels of wheat can be picked up by a neon light relaxation oscillator. But this process will not reveal the presence of dead insects within the grain. Attempts are now being made to develop a sensitive instrument that will select individual infested kernels in a sample.

The third approach is a rather comprehensive study of the flotation method, in which some very interesting facts have been demonstrated. Flotation, wherein the goal is to submerge a sample in a liquid and float off all the kernels containing internal infestation, has never given clear-cut results. Advanced stages of infestation are fairly easily separated, but the early stages have not changed the kernel weight sufficiently to cause it to float. The picture is further confused in that lightweight sound kernels also float.

In the current experiments it was found that the specific gravity of a solution containing certain chemicals could be set at a point where all kernels that floated were infested, but some infested ones still remained submerged. As the specific gravity was increased step by step, the number of infested kernels remaining submerged decreased until a point was reached where all infested ones floated. As this point was approached, some lightweight sound kernels also appeared in the fraction that floated.

When the solution contained two nonmiscible chemicals of different specific gravities, a three-layer separation resulted. A combination of specific gravities was found that floated practically all infested kernels in one or the other of the two floating layers, yet kept practically all lightweight sound kernels out of the top one. The kernels in the top layer were in advanced stages of infestation. The early stages of infestation appeared in

the second layer. This separation was obtained with wheat of various moisture contents and of various test weights. Studies are now underway to see if a satisfactory flotation method for rapid detection of hidden infestation can be evolved from the results of this research.

Problems of Grain Moisture and Temperature

Grain moisture content and grain temperature are two of the most important factors in the safe storage of grain. When grain is too damp for safe storage, it should be mechanically dried if it is to be held in storage for any length of time. A wide range of types and capacities of driers have been developed and are available for doing this job both on the farm and at the country elevator. Recommended drying air temperatures and air-flow rates have been established which will avoid damage to grain, such as loss of germination, scorching, "case-hardening" of kernels, reduction in baking quality, checking of kernels, and molding which may occur if the drying process is prolonged.

High temperatures in stored grain encourage mold growth, insect activity, and other storage difficulties. Such grain should be cooled by mechanical aeration or turning. The temperature variations that normally occur in bulk-stored grain during the changing seasons also can increase the problems connected with quality maintenance.

During the fall and winter, grain near the bin wall and surface cools faster than the grain in the center portion of the mass. At a 5-foot depth the grain temperature changes may be from 2 to 3 months behind those occurring near the surface and outside walls; at an 11-foot depth they may be as much as 5 to 6 months behind.

These differences in grain temperatures are responsible for convection air currents within the grain mass. The air in the cooler, outer layers of the grain becomes heavier and moves downward. At the same time, air in the warmer central portions of the grain bulk becomes lighter and moves upward, for the same reason that there is a draft upward in a house chimney. These air movements are slow, but are continuous as long as temperature differences exist.

There is always a tendency for moisture to move from the warmer grain to the cooler grain. During the fall and winter this moisture tends to move upward because of the effect of the rising convection currents taking place within the central portion of the grain bulks. As the warmer, moist air reaches the cooler grain near the surface, condensation generally takes place to a degree depending upon the conditions of the grain and the atmosphere. Some molding and caking of the surface grain often accompanies this accumulation of moisture. In extreme cases moisture and temperature conditions may become such that sprouting of the grain may occur over much of the grain surface. Condensation on the underside of the roof often accompanies high moisture accumulations in the surface grain.

Elevator operators follow the practice of periodic "turning" of grain from one bin to another where grain is stored for more than a few weeks.

Turning is generally done during cold or cool weather for the purposes of cooling the grain or at least equalizing the grain temperatures, breaking up localized trouble spots in the grain mass, and for a visual inspection of the condition of the grain. The short period of time that grain is exposed to the air during turning generally reduces the grain temperature only 6 or 7 degrees in the coldest weather. Repeated turnings are necessary to accomplish the effective cooling of warm grain. Recent research indicates that as good or better cooling can be accomplished by use of aeration systems (that is, motor-driven fans and blowers) to circulate cool outside air through the stored grain. With this method, cool air is passed through the grain rather than the grain being passed through the cool air as in turning. Empty storage space is not needed with aeration where the grain is not turned, and grain breakage and damage is held to a minimum. If weather and bulk temperatures are not cold enough to stop insect activity, turning may increase the insect problem by distributing the infestation unless the turning is combined with fumigation.

Studies made on grain stored at Government-owned bin sites provide considerable proof that mechanical aeration of stored grain is effective and practical for maintaining the condition of grain stored with moisture contents within the recommended ranges. Cooling the grain equalized the temperatures of the grain mass, thus eliminating the convection currents which are responsible for moisture migration and subsequent moisture accumulations.

When high moisture accumulations are prevented, caking and molding of surface grain is minimized, which also helps to reduce any insect activity in these areas.

In our research work we are fully aware of our responsibility for the development of more effective and efficient procedures, equipment, and practices for maintaining grain quality. It is our intention to provide the best ammunition possible in the battle for cleaner and better quality grain supplies. Today I have touched upon a few of the phases of the research concerned with maintaining grain quality. The discussion period which follows will serve to bring out many other facets of the problem, as well as specific findings on specific problems which many of you have in your day-to-day activities.

RECOMMENDATIONS OF WORK GROUP

John Winfield, North Carolina, Chairman
Mark D. Worcester, North Dakota, Secretary

In addition to research results reported, it is recommended that further studies be made to:

1. Develop a sanitation and quality standard that can be accepted at the local level and at the terminal, and develop a simplified and quick method of testing to measure the extent of contamination through all channels of the marketing of grain.

2. Minimize deterioration of grain by the use of fumigation sprays and dusts.

3. Determine the most efficient drying procedure to maintain the quality of grain.

Federal and State Departments of Agriculture and other interested agencies should cooperate to the fullest extent to sponsor grain sanitation and quality programs. For these programs to operate effectively, it is essential that producers and marketing agencies do their part, and the cooperation of others connected with the grain trade and processing should be enlisted. Suggested action to be taken by marketing service personnel as the result of research information now available is listed below.

1. Assist grain marketing facility operators in complying with the new tolerances for rodent and insect infestation as prescribed by the Food and Drug Administration, and encourage operators of grain handling and marketing facilities to:

   (a) Clean up storage tanks and warehouse areas and spray the interior of the facility.
   (b) Make bins rodent-, bird-, and moisture-proof.
   (c) Discourage rodents by removing all trash and other possible rodent shelters and use bait where necessary.
   (d) Spray surface areas and fumigate grain while in storage frequently enough to keep down insects.

   This job can be done through personal contact, group meetings, newsletters, radio and television, other local agricultural workers, and trade associations.

2. Promote improvements in drying and storage facilities and equipment which will more effectively retard deterioration due to moisture and prevent insect infestation. Such improvements might include:

   (a) Additional storage facilities in the Southeast and other areas where needed, through close association with members of the trade and persons or firms interested in expanding their operations or in building new grain marketing facilities. Surveys should be made to determine grain production, marketing facilities, volume movement, processing plants, transportation conditions, weather, etc. to be used in promoting new facilities or the expansion of existing facilities. The facilities should be rat-, bird-, and moisture-proof. This will enable us to fumigate and control insects as well as rats and birds.
   (b) The installation or addition of grain dryers. Frequently, in the high humidity areas in the East and Southeast, grain needs to be dried for market or for safe storage. Losses as the result of storing with too much moisture will help convince the operator that a dryer is needed.

(c) The manufacture of grain dryers to meet the requirements of the area in which they will operate. For instance, an area with a high humidity and relatively high temperature even in winter months will need a dryer with a larger cooling capacity.

3. Distribute more widely information on aeration. A handbook is needed to cover the difference between aeration and drying equipment and to emphasize the difference between moisture and temperature control of grain in storage.

REDUCING DETERIORATION AND SPOILAGE OF FRUITS AND VEGETABLES IN MARKETING CHANNELS

Harold T. Cook, Biological Sciences Branch,
Agricultural Marketing Service, U.S.D.A.

It is frequently stated that losses of fruits and vegetables from spoilage and deterioration between the farm gate and the home would feed millions. But actual figures on these losses are too few and inadequate to express their real extent and magnitude.

About two years ago the U. S. Department of Agriculture published a preliminary appraisal of "Losses in Agriculture." Losses in fruits during marketing were equivalent to the production of 326,000 acres and had a market value of over $96,000,000. Losses in vegetables were equivalent to the production of over 1,000,000 acres and had a market value of over $206,000,000. It is felt that these estimates are on the conservative side and that losses actually were much larger.

A survey of fruit and vegetable losses over a three-month period in 200 homes in Knoxville, Tenn., indicated losses as follows: Apples, 4 percent; bananas, beans, and cabbage, 3 percent; celery, tomatoes, and peppers, 7 percent; lettuce, onions, and oranges, 10 percent; potatoes, 8 percent; sweetpotatoes, 12 percent; and strawberries, 15 percent.

Railroad freight claims paid for loss and damage to fruits and vegetables are a good indication of the magnitude of the losses. Claim payments amounted to about $20,000,000 on about 1,000,000 cars of fruit, melons, and vegetables in 1946; about $14,000,000 in 1951; $15,000,000 in 1952; $14,000,000 in 1953; and $12,000,000 in 1954.

Analysis of 117,643 inspection certificates representative of about 16 percent of the cars of fruits and vegetables unloaded at New York City between 1935 and 1942 demonstrated the magnitude of the losses in fruits and vegetables from market diseases alone. Losses in individual cars of fruits ranged up to 69 percent for peaches, 39 percent for pears, 59 percent for plums, 34 percent for strawberries and apples, 49 percent for cherries, and 24 percent for grapefruit.

Losses in individual cars of vegetables ranged up to 54 percent for globe artichokes, 44 percent for asparagus and beans, 90 percent for broccoli, 99 percent for celery and lettuce, 89 percent for onions, 94 percent for peppers and spinach, 64 percent for potatoes, and 84 percent for tomatoes.

The causes and magnitude of losses vary in different shipments, from different areas, with different kinds of fruits and vegetables, and at different seasons. Besides market diseases, large losses also are caused by overmaturity, bruising, freezing, heat, and other causes.

The problem of deterioration and spoilage during marketing has been with us many years. In the report of the Commissioner of Patents in 1861, Professor L. C. Loomis wrote, "Now it is to be observed that but a small portion of the ordinary supplies of our large cities is in proper condition when offered in market. The desire of securing the high prices of the earliest products induces the gathering of the first growth while yet unripe, and of that which remains till fully matured the succulent fruits and vegetables commence decay before reaching the termination of the distances large quantities are transported."

In the report of the Commissioner of Agriculture for the year 1869, a correspondent in California wrote, "Shipping fruit east has been a failure thus far. This result is owing entirely to want of knowledge on the subject. Most of the fruit shipped has been picked while green and being poorly packed, has been lost before it reached the eastern markets. There can be no question that our apricots, cherries, pomegranates, pears, and grapes can be placed in New York in good condition and command high prices, but the science of picking and packing must first be understood."

These two correspondents showed a remarkable grasp of the problem and solution for their time. Later, in 1900, Dr. William A. Taylor demonstrated that with proper refrigeration it was possible to ship fresh apples and oranges long distances and prolong their market season. By this means, he maintained a continuous exhibit of oranges from California and apples from 17 States at the Paris Exposition. In 1908, G. Harold Powell published results of shipping tests in which he demonstrated that decay of California citrus fruit in transit could be prevented by improved picking, handling, packing, shipping, and refrigerating. H. J. Ramsey, in 1915, showed that losses in shipments of red raspberries from Washington could be reduced by careful handling, precooling, and refrigeration in transit.

Further advances were made about 1917 when, with the inauguration of the Food Products Inspection Service in the Bureau of Markets, there came an urgent need for information on the identity, causes, and control of diseases that cause loss in fruits and vegetables during marketing. Market disease laboratories were established in Chicago and New York, and extensive surveys were made at the shipping points, packinghouses, and receiving points. Manuals on market diseases of fruits and vegetables were first published as guides for the inspectors in 1919. These have since been elaborated into a series of 9 market disease manuals with colored illustrations of the principal market diseases.

Since the 1920's much progress has been made in the handling of fresh fruits and vegetables in marketing channels. Harvesting methods have been improved, refrigerator cars have been modernized, better methods of refrigeration have been developed, and there have been important changes in packing. The quality and variety of fruits and vegetables now available on the markets were never better. However, there is still need to reduce losses and improve the quality, and this need can be met by continued study of the problems and adoption of new and better methods. With better understanding of the causes of spoilage, it is now becoming possible to tailor the methods of handling to the needs of the specific kind of fruit or vegetable and the market to which it is to be shipped.

The basic principles in reducing deterioration and spoilage are:

1. Knowledge of the requirements of the fruits or vegetables.
2. Harvesting disease-free fruits or vegetables at the optimum stage of maturity to insure good eating quality and ability to stand shipment.
3. Harvesting carefully to avoid cuts, bruises, or other injuries that make the fruit or vegetable unattractive or more subject to decay.
4. Properly trimming, washing, grading, and packing to make an attractive product and preserve quality.
5. Properly precooling and refrigerating in storage, transit, and during marketing according to the need of the product.

RECOMMENDATIONS OF WORK GROUP

George H. Chick, Maine, Chairman
Leon Scott, Mississippi, Secretary

All of us are aware of the tremendous loss of fruits and vegetables that occurs each day in the marketing channels. The product not only loses some of its freshness, flavor, and attractive appearance, but in many cases becomes unfit for human consumption. What brings about these quality losses, deterioration, and spoilage, and what can be done to reduce them?

It was the belief of the work group that more assistance should be given to fruit and vegetable growers, shippers, distributors, and retailers in learning and applying the best methods of maintaining quality throughout the entire marketing process. Some of the better practices are:

1. Eliminate unsuitable varieties of fruits and vegetables.
2. Avoid, when possible, harvesting during unfavorable weather, such as periods of high temperatures, low temperatures, or excessive moisture.
3. Eliminate rough handling during harvest.
4. Pick produce, such as peaches and tomatoes, for top maturity.
5. Use the best equipment for grading, washing, and waxing in order to minimize bruising.
6. Eliminate improper packages and packing, and improper loading and unloading.

7. Precool as soon as possible, either by precooling equipment or by use of fans on most refrigerator cars, by attaching a gasoline or electric motor.
8. Use proper refrigeration or heater service during transit. Failure to do so may cause overheating, chilling or freezing, overmaturity, or shriveling or withering.
9. Bill cars or trucks correctly so as not to cause delay in transit.
10. Use proper refrigeration in wholesale and retail market.
11. Display products attractively and sell older products first.
12. Properly grade all fruits and vegetables at shipping point.
13. Eliminate sale of misbranded products, as this practice invariably causes trouble and finally develops into a loss and deterioration of the product involved.
14. More adequately protect bottom layer of packages in cars or trucks, especially sacked products.
15. Study handbooks issued by the U. S. Department of Agriculture on market diseases of the more important fruits and vegetables in order to be able to identify the causes of spoilage.

Some methods for improving the quality of canned and frozen products are:

1. Harvest products properly.
2. Control the quality of products.
3. Use suitable varieties.
4. Condition some products, such as potatoes, before processing.
5. Avoid overcooking products, such as tomatoes.

The group believes that more information is needed on devices for measuring maturity in order to assist growers in determining when to harvest to insure maximum quality.

MAINTAINING THE QUALITY OF POULTRY AND EGGS

Lyle L. Davis, Biological Sciences Branch,
Agricultural Marketing Service, U.S.D.A.

It would have been an easy but time-consuming job to develop abstracts of research papers published in the last year that dealt with the retention of quality in poultry and eggs in the market. However, in the short time at my disposal at this meeting, I could not present all of the abstracts nor comment on them. Instead, I have selected some of those research papers most apt to have an immediate effect on marketing practices.

Eggs

Improved breeding, better housing, and better nutrition have all played their part in increasing the number of eggs laid per hen per year. In spite of the high rate of production, our scientists are still not satisfied. The search for better bred hens, more economical housing that does not sacrifice

egg production, and improved feeds goes on. Many studies have been directed toward preserving the physical quality of eggs. A few have dealt with loss of nutritive value in stored eggs.

Egg production practices in more and larger areas of the country seem directed toward an even supply of eggs throughout the year. The aim is to avoid widely fluctuating supplies that overload markets with eggs at certain periods in the year and undersupply them at other times. Our poultry industry must store the surplus eggs, produced principally in the Midwest, until production practices level out seasonal high and low production. We know that the physical properties of shell eggs change in storage. Certain chemical changes also occur. Evans, Bandemer, Bauer, and Davidson (5) 2/ showed that fresh shell eggs contained, on the average, 387 millimicrograms of vitamin B12 per egg (6.54 millimicrograms per gm.) in the yolk and 25 millimicrograms (0.65 millimicrograms per gm.) in the albumen. No change in the vitamin B12 content of the egg albumen was observed during 12 months of cold storage, but about 1/3 of the vitamin B12 was lost from the whole egg. Most of this loss occurred during the last 5 months of storage.

King and Hall (7) presented data in the New York Random Sample Test to show that breed, strain, and season of production affect quality of shell eggs. They concluded:

1. In the fall months of the pullet year, when albumen quality is highest, only about 65 percent of the eggs graded AA on a broken-out basis (Haugh units).

2. By March this percentage is down to 40, and by June it is no more than 20.

3. The albumen quality differed among strains of White Leghorns and Rhode Island Reds, while strains tested among the other breeds (New Hampshires, Barred Rocks, White Rocks) did not differ.

4. Breed differences in incidence of blood spots were significant, and the differences were due to the higher incidence of blood spots among the Leghorn strains than among the heavy-breed strains.

5. Approximately 4 percent of all eggs broken out showed large blood spots, and if one adds these large blood spots to the 10 to 15 percent large meat spots observed, it becomes apparent that 15 to 20 percent of all eggs laid in the test were inedible according to official egg grading standards.

6. All but a fraction of 1 percent of the meat spots observed in white shell eggs were white in color and only the very largest of these white spots were noticeable, while the meat spots in brown shell eggs were of varying shades of brown, being correlated fairly closely with shell color.

2/ Numbers in parentheses refer to "Literature Cited," pp. 54-55.

7. Differences in shell thickness among breeds were highly significant, but not among strains; the Rhode Island Red strains had the thinnest shells, while the Barred Rock strains had the thickest.

8. Shell thickness and albumen quality were not related.

Pope and Watts (14) found the percent shell and specific gravity of the whole egg followed a similar trend. Spring-hatched pullets came into production with high shell quality and continued producing eggs with high-quality shells until February, after which the shell quality decreased. Fall-hatched pullets began producing eggs with low shell quality and continued to do so until December, which was a month after environmental temperatures had dropped below an average high of 70° F. The interior quality (as measured by Haugh units) of the eggs from both groups of pullets decreased each succeeding month throughout the experimental period. Specific gravity of eggs seemed not to be correlated with these factors.

Morrison, Stadelman, and Darroch (12) purchased in Seattle markets, and broke out for quality measurements, 350 dozen shell eggs per season in 3 consecutive seasons, fall, spring, and summer. The seasonal quality of all brands was 69.8 Haugh units in the fall, 66.1 in spring, and 60.7 in summer. There were no significant differences between brands. There was a greater variation in quality in summer eggs than in fall or spring. Eggs purchased from refrigerated display cases averaged almost 5 Haugh units higher in albumen quality than eggs from nonrefrigerated displays.

It has been generally accepted by research personnel and those engaged in storage or marketing of eggs that the quality of the white in shell eggs will drop about 5, 3, and 0.7 Haugh units per day, respectively, at temperatures of 90°, 70°, and 50° F. in the first few days of storage. Ten Haugh units are lost in the first 14 days of storage at 55° F. with an 80 percent relative humidity. After the initial high rate of loss of albumen quality, the rate decreases according to the storage temperatures. Cotterill (3) presented data to show that the natural thinning of thick white during short storage periods, as indicated by Haugh units, was not a function of temperature, if the pH was maintained near its initial value by increasing the carbon dioxide concentration in the atmosphere surrounding the shell eggs. The subsequent thinning of thick white under normal atmospheric conditions was retarded after the eggs were exposed to a carbon dioxide treatment. He used a lighted candle or alcohol lamp in a sealed container of shell eggs to decrease the oxygen level and increase the carbon dioxide level. Deterioration of thick white was prevented, and mold development was retarded. When eggs were gathered in a pail which could be sealed to retain carbon dioxide, the interior quality was better than in eggs gathered in a wire basket. The beneficial effects remained evident after an additional 48 hours at room temperature under normal atmospheric conditi---

White-Stevens, Zeibel, and Smith (16) made field experiments on the feeding of aureomycin to laying and breeding hens (White Leghorns and New Hampshires) in Georgia, New Jersey, Utah, and Washington over a 2-year period. They showed that antibiotic fed at from 50 to 200 gm. per ton on a total diet intake on a

continuous basis significantly increased egg production, increased egg weight, reduced feed-egg ratio, and, in the case of breeding hens, enhanced hatchability. The differences were greater where the layers and breeders were undergoing stress from certain diseases, particularly chronic respiratory diseases. Fifty gms. aureomycin per ton of total feed were optimal for Leghorns, while 100 gms. per ton of total feed were found optimal for New Hampshire chickens.

Poultry

Milligan, Wilcke, Marr, and Bethke (11) reported that the addition of 0.005 percent arsenic acid to commercial-type broiler diets containing effective feeding levels of antibiotic produced among other things: (1) An improvement in market grades of chicken broilers, and (2) a nontoxic level of arsenic in the tissues of birds. Odlund, Mayfield, and Page (13) reported that the addition of fish solubles, at a 3-percent level, did not improve palatability scores for S. C. White Leghorn broilers. Palatability scores for the tenderness and texture of Leghorn broilers 12 weeks of age receiving a supplement of 20 mg. vitamin B12 and 20 mg. aureomycin per kg. of ration were significantly higher than scores for the control birds. The eating quality of 24-week-old Broad-Breasted Bronze turkeys showed no particular benefit from the same supplement. However, fish solubles at a 3-percent level in the rations of Broad-Breasted Bronze turkeys improved the aroma, flavor, juiciness, and general desirability of the light meat and the flavor, tenderness, and texture of the dark meat. No off-flavor was attributed to the use of fish solubles when the cooked samples were scored fresh or after frozen storage for 6 months.

It takes about 3 hours after feeding live birds to empty the crop of mash. Considerably more time elapses before the intestinal tract empties. Poultry with empty crops are easier to eviscerate than birds with full crops. If the intestinal tract were empty the "bar truss" would be easier to make without spreading fecal matter in the body cavity while eviscerating. A short starvation period, during which water is freely available to the birds before killing, is used frequently by poultry processors. May and Brunson (10) showed that both male and female broilers starved for 24 hours yielded significantly lower eviscerated weights than did those starved 12 hours or less.

When turkeys were scalded at 126° to 128° F., the most common complaint to the processor from the consumer was that the carcasses had too many pin feathers. Now, most packaged, frozen, ready-to-cook turkeys are scalded at 140° F., and the most common complaint is that the turkeys are tough. Klose, Hanson, Pool, and Lineweaver (8) have data showing the pectoralic major muscle was more than 4 times as tough (shear-force measurements) for turkey fryer-roasters frozen 1 or 2 hours after killing as for birds frozen 20 hours after killing. A time lapse of 3 to 6 hours between killing and freezing is frequently not sufficient to assure tender meat if cooking is from the frozen state. Freezing only arrests the rate of tenderization; it will continue after thawing. Frozen ready-to-cook turkeys should be allowed to thaw and become tender before cooking, or the processor should age the carcasses adequately before freezing.

Spencer, Sauter, and Stadelman (15) reported that the odor and slime of thawed broilers, previously held frozen up to 2 months in tray packages, was the same for unfrozen fresh controls. Flavor comparisons of fried broilers indicated no detectable differences. Extracted broth differences were detected by a trained panel. Fresh controls showed no bone darkening, but all broilers frozen showed bone darkening. If it is true that turkey bones do not darken when frozen, that is probably because of the greater degree of calcification in the turkey bones than in the bones of chicken broilers.

Total bacterial numbers on dressed or ready-to-cook poultry are not directly related to the shelf life of such poultry. Bacteria do not immediately begin to multiply (grow) on the skin or interior surfaces of ready-to-cook poultry when the carcasses leave the evisceration line. There is a time lag during which no measurable increase in numbers of bacteria occur. The duration of this time lag on poultry is dependent on the temperature, availability of nutrients for bacterial growth, species of bacteria, and number present. Baker, Naylor, Pfund, Einset, and Staempfli (1) presented data that showed the time lag period for bacterial growth as 8 days on ready-to-cook broilers with an initial bacterial count of 1,500, held in crushed ice, where all water was allowed to drain away as rapidly as formed; as 4 days on ready-to-cook broilers in a mechanical refrigerator at 35° F.; and as less than 2 days on ready-to-cook broilers in a mechanical refrigerator at 45° F. They further showed that the development of odor, and hence unacceptable spoilage, of broilers was not directly related to total count of bacteria. On ready-to-cook broilers held at 35° F., odor developed on the tenth day of storage with a total bacterial count of 1 million, while at 45° F. odor developed on the ninth day with a total bacterial count of 100 million. Bacterial counts within storage conditions did not appear to influence materially the flavor rating of the cooked broilers. Off-flavor first appeared in the livers, gizzards, thighs, and oysters. Loss of flavor was appreciably slower in the breasts and wings.

Sanitation in the poultry processing plant has been shown to be of value in reducing the initial bacterial count on ready-to-cook poultry. Drewniak et al (4) suggested that water be used in such amounts as to wash away bacteria wherever possible, that equipment be inspected periodically to see that it is maintained in the best working condition, that hand-washing facilities for workers be provided wherever the birds are handled, that birds not be allowed to touch or brush surfaces of equipment unless water is flushed over the surfaces, and that chlorinated water at a concentration of 10 to 20 p.p.m. above the breakpoint be used in washers and sprayers and in the cleanup water. Germicidal dips or other cleaning agents when properly used on equipment will also materially aid in lowering the bacterial counts on carcasses and processing equipment.

Gunderson, McFadden, and Kyle (16) in their extensive report declare that a residual of 10 to 20 p.p.m. chlorine in the wash water in poultry processing plants resulted in a greater reduction in bacterial populations on the skin and cavity surfaces of poultry passing through the dressing and evisceration procedures than when in-plant chlorination was not used. Other advantages were a marked reduction in cleanup time and elimination of characteristic odor of poultry processing plants. This procedure did not produce any change in appearance of the raw product or the taste of the cooked product.

Kohler, Miller, and Broquist (9) reported that, of the antibiotics tried, streptomycin, neomycin, chloramphenicol, magnamycin, bacitracin, procaine penicillin, erythroymcin, polymyxin B, actidione, and aureomycin, only the last mentioned was effective in suppressing the growth of organisms taken from the surface of spoiling chicken and plated out on nutrient agar containing the various antibiotics. When cut-up poultry was dipped for 30 minutes in aureomycin solutions (3, 10, or 30 p.p.m.), it remained fresh and edible and had a lowered bacterial count significantly longer than untreated controls. Ready-to-cook broilers immersed for 2 hours in a cooling tank containing 10 p.p.m. aureomycin were still in a satisfactory condition after 21 days of commercial storage at 3° C. The antibiotic present in the tissues, varying in amounts in different tissues, was readily destroyed by conventional cooking procedures even when solutions containing 100 times more aureomycin than necessary for preservation were employed. For further references, see Campbell and O'Brien (2), who reviewed the literature on antibiotics in food preservation and cited 75 preferences.

Literature Cited

1. Baker, R. C., Naylor, H. B., Pfund, M. C., Einset, E., and Staempfli, W. 1954. Keeping Quality of Ready-to-Cook and Dressed Poultry. Mimeo. Cornell Univ. Agri. Expt. Sta. Ithaca, N. Y.

2. Campbell, Leon L. Jr., and O'Brien, R. T. (Wash. Agri. Expt. Sta.). 1955. Antibiotics in Food Preservation. Food Tech. 9 (9): 461-465.

3. Cotterill, Owen J. (Iowa Agri. Expt. Sta.). 1955. The Effect of Carbon Dioxide, Mechanical Shaking, and Thioglycol on the Thinning of Egg White. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

4. Drewniak, Edwin E., Howe, Milton A. Jr., Goresline, Harry E., and Baush, Edward R. 1954. Studies on Sanitizing Methods for Use in Poultry Processing. U. S. Dept. of Agri. Cir. 930: 1-30.

5. Evans, R. J., Bandemer, S. L., Bauer, D. H., and Davidson, J. A. 1955. The Vitamin B12 Content of Fresh and Stored Shell Eggs. Poult. Sci. 34 (4): 922-928.

6. Gunderson, M. F., McFadden, H. W., and Kyle, T. S. 1954. The Bacteriology of Commercial Poultry Processing. Burgess Pub. Co.

7. King, Steven C., and Hall, G. O. (Cornell) 1955. Egg Quality Studies at the New York Random Sample Test. Poult. Sci. 34 (4): 799-809.

8. Klose, A. A., Hanson, Helen L., Pool, M. F., and Lineweaver, Hans. (Western Regional Utilization Laboratory, Albany, Calif.) 1955. Toughness in Frozen Birds Aged for Various Times. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

9. Kohler, A. R., Miller, W. H., and Broquist, H. P. (Amer. Cyanamid Co.) 1955. Aureomycin Chlortetracycline and the Control of Poultry Spoilage. Food Tech. 9 (3): 151-154.

10. May, K. N., and Brunson, C. C. (La. Agri. Expt. Sta.) 1955. Effect of Length of Starvation Period on Eviscerated Yield of Broilers. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

11. Milligan, J. L., Wilcke, H. L., Marr, J. E., and Bethke, R. M. (Ralston Purina Company, St. Louis). 1955. Arsenic Acid in Commercial Broiler Rations. Poult. Sci. 34 (4): 794-798.

12. Morrison, Mary A., Stadelman, W. J., and Darroch, J. G. (Wash. Agri. Expt. Sta.) 1955. Quality of Shell Eggs in Seattle Retail Stores. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

13. Odlund, Lura M., Mayfield, Helen L., and Page, Louise. (Mont. Agri. Expt. Sta.) 1955. The Influence on Palatability of Certain Grain Combinations, Fish Solubles and a Vitamin B12 - Aureomycin Supplement in Poultry Rations. Poult. Sci. 34 (4): 822-831.

14. Pope, C. W., and Watts, A. B. (La. Agri. Expt. Sta.) 1955. Effect of Season on Egg Quality and Certain Blood Constituents. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

15. Spencer, J. V., Sauter, E. A., and Stadelman, W. J. (Wash. Agri. Expt. Sta.) 1955. Shelf Life of Frozen Poultry Meat after Thawing. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

16. White-Stevens, R., Zeibel, H. G., and Smith, F. (Amer. Cyanamid Co., Pearl River, N. Y.) 1955. Effect of High Level Antibiotic Feeding on Production Efficiency of Laying and Breeding Chickens and Turkeys. Abstracts of papers presented at the 44th Annual Meeting of the Poult. Sci. Assoc. August 9-12.

RECOMMENDATIONS OF WORK GROUP

Tom Fox, Oklahoma, Chairman
Hunter Hering, Michigan, Secretary

Studies on the maintenance of quality in both poultry and eggs have been conducted by many researchers, and the results have been made available to those of us in marketing service work and to the poultry and egg industry. This work group has reviewed some of the findings as applied to quality maintenance and was in general agreement with them. The group also reviewed many

practices of the poultry and egg industry, and found that the industry could do a much better job of maintaining quality by putting into practice many of the findings that have been developed from this research work. Marketing service people constantly must bring this information to the processors and handlers to help them maintain quality at all times.

First of all, producers should be encouraged to handle and deliver poultry and eggs in such a manner as to maintain the high quality produced, to eliminate as many handlings as possible, and to reduce damage to the product. Truckers and processors should be informed of damage that occurs to the product by mishandling.

Second, several general types of marketing information should be considered. One type consists of the so-called basic information, which reflects quality changes taking place in the movement of poultry and eggs from producers to market. For example, information should be provided on proper care during handling and transportation from farm to market to reduce the bruising of live poultry, to eliminate diseased birds, to reduce check in egg shells, to reduce the breaking of air cells, and to protect from heat during the journey from farm to market. Another type of information should cover that period of time from the first receiver to the consumer—for example, information on care in the handling of poultry to reduce bruising and bacterial contamination in processing and distribution; information on the proper grading, sizing, and handling of eggs; information on the proper temperatures at all times to maintain the highest possible quality of both poultry and eggs and the development of new and better packages and packaging methods.

QUALITY MAINTENANCE AND GRADING OF LIVESTOCK

HOW TO MARKET HOGS TODAY

George F. Henning,
Department of Agricultural Economics and
Rural Sociology, Ohio State University

For a long time, the marketing of hogs has been based primarily on averages. Only recently has some effort been given to marketing on a basis of actual values. Several longtime shifts or trends have been underway. One of these trends has been the downward price of lard. For example, refined lard in New York was selling in 1920 at a price 63.5 percent higher than the average price of live hogs in Chicago; in 1925, 51.4 percent; in 1930, 32.7 percent; in 1940, 29.6 percent; in 1945, 12.6 percent; and in 1950, 8.1 percent. These figures were obtained from the U. S. Department of Agriculture.

Today raw fat is worth about 9 cents per pound to the packer. Live hogs have been selling recently from 12.90 to 14 cents per pound at Chicago. A 200-pound live hog, let us say, brings $28. As soon as that hog is slaughtered, the packer has a carcass weighing about 140 pounds, costing $28 or 20 cents a pound. In other words, the raw fat has cost the packer 20 cents a pound, but it is worth only 9 cents to him, depending, of course, upon the wholesale price

of lard and live hogs. Lard is no longer a profitable product for farmers to produce and the packer gets only about half the wholesale price for lard compared to carcass cost, because today we have a super-abundance of fats and oils.

There is another trend of which many farmers are unaware. Swine producers are facing more competition from other meats, especially broilers and turkeys as well as beef. The per capita consumption of poultry has increased as follows:

Year	Chicken and broilers Pounds	Turkey Pounds	Total Pounds
1940	13.9	2.9	16.8
1950	20.3	4.0	24.3
1954	23.7	4.5	28.2

Source: U. S. Department of Agriculture

Per capita consumption of pork for the same years was 72.4 pounds in 1940, 68.1 pounds in 1950, 62 pounds in 1954, and it is 66 pounds for 1955.

There also has been a trend for the consuming public to use less fats and oils and more protein. Many people, especially women, want to be slimmer. When they eat meat, they want it to be lean meat. Therefore, it seems to me that the hog producer has no other alternative than to produce hogs that have more lean meat.

The marketing system must be modified so that the farmer is more nearly paid for the value of the hog he produces. Marketing research conducted by the North Central States in recent years has paved the way. This research deals with selling hogs on a graded basis: No. 1, the high valued hogs; No. 2, the average valued hogs; and No. 3, the lower valued or fat hogs.

What is a No. 1 hog? For a 200- to 220-pound hog, it is one that has 51.5 percent or better of the carcass weight in the 4 lean cuts (hams, loins, picnics, and butts), whereas a No. 3 hog has only 47.5 percent or less of the carcass weight in these cuts. Of course, these standards can be changed or adjusted according to the desires and experiences of the meat industry.

A 200- to 220-pound hog should produce a carcass that should be 30 inches in length or slightly more, and have an average backfat thickness of 1.6 inches or less, probably not less than 1 or 1.2 inches. A No. 3 hog will produce a carcass about 29 inches long or less and an average backfat thickness of 1.9 inches or more. These standards can be obtained from the U. S. Department of Agriculture or from Ohio Bulletin 728 (page 58). The No. 2 hog, of course, will fall between the No. 1 and No. 3 grades. Cull and underfinished hogs are not considered in these grades.

Current research carried on by the Ohio Agricultural Experiment Station, in cooperation with the Farmer Cooperative Service of the U. S. Department of Agriculture, indicates that the No. 1 hog in September 1955 should have been valued at 80 cents per hundredweight over the No. 2 hog, and the No. 3 hog, 50 cents per hundredweight under the No. 2 hog. In October the respective values were 70 cents for No. 1 over No. 2 hogs, and 40 cents for No. 3 under No. 2 hogs. In other words, in September the No. 3 hog weighing from 200 to 220 pounds should have sold for $1.30 per hundredweight less than the No. 1 hog, and in October $1.10 less. This method would more properly price the meat that the packer and retailer can obtain from No. 1 and No. 3 hogs, and would compensate the farmer for producing a leaner, meatier No. 1 hog.

It is my conviction that the marketing system must recognize these differences in values and adopt an improved system of differentials. Farmers' prices for wet corn (20 percent moisture) are discounted. Likewise, light wheat (56 pounds per bushel) and milk with a high bacteria count bring a lower return to the farmer. Therefore, hog producers should receive less for No. 3 hogs. These hogs are not wanted by consumers, and produce too much lard.

The meat from No. 1 hogs most likely will compete better with other meats. Some packers are commencing to sell pork from No. 1 hogs at higher prices, and consumers will pay more for lean pork chops. (See speech on "Current Research on Consumer Preferences for Meat Quality," by Harold M. Riley, page 59.) Farmers should produce leaner, meatier hogs, and market agencies should modify the marketing system to recognize the proper value of No. 1, No. 2, and No. 3 hogs. Packers should insist on buying hogs at their real value. The entire swine and pork industry, under such a system, will be better able to compete with other meats in the future.

Can farmers afford to produce No. 1 hogs? Research is answering that question. The Ohio Swine Evaluation Station has just completed one year's operation on this study, and the results have been evaluated. The 420 hogs covered by the study (210 pairs—a barrow and a gilt from each litter) were handled the same way and fed the same ration. Most of the hogs were from the swine-breeding herds of the State, and most of the farmers who furnished the hogs thought them to be above average. Many of the herds from which these hogs came were furnishing seed stock to the commercial herds in Ohio.

Of the 420 hogs, according to the standards previously described, 112 graded No. 1, 256 graded No. 2, and 52 graded No. 3. Now, let us note the performance of these 420 hogs.

Grade	Carcass weight in 4 lean cuts	Feed required for 100-pound gain	Average daily gain	Average backfat thickness	Body length	Live weight in fat trim
	Percent	Pounds	Pounds	Inches	Inches	Percent
No. 1	52.6	338	1.67	1.55	30	15.1
No. 2	49.4	341	1.72	1.64	30	16.6
No. 3	46.2	357	1.69	1.83	29.2	19.3

This performance record shows that percentage of carcass weight in the lean cuts, feeding ability, backfat thickness, and percentage of live weight in fat trim are in favor of the No. 1 hogs. As shown above, No. 1 hogs had 6.4 percent more weight in the 4 lean cuts than the No. 3 hogs. The size of the loin eye was 4.1 square inches for No. 1 hogs, 3.7 square inches for No. 2, and 3.3 square inches for No. 3. Which pork loins would you rather sell as a farmer or buy as a consumer?

We need to identify and produce more seed stock that will give us hogs like the No. 1's above. The swine breeders and geneticists have a real challenge to produce better seed stock. We need superior hogs, "super-duper hogs," a hog with a bigger loin, meatier ham, and 60 percent of the carcass weight in the 4 lean cuts. The top 16 hogs in the Station produced carcasses that had 54.6 percent of the carcass weight in the lean cuts, 1.5 inches average backfat, 14 percent of live weight in fat, and 100 pounds of gain from 338 pounds of feed. One pair had 57 percent of carcass weight in the 4 lean cuts, and another pair had 55 percent. Therefore, it seems to me that the superior hog with 60 percent of the weight in the 4 lean cuts is a near possibility. The geneticists have given us superior poultry, the broad-breasted turkey, and hybrid seed corn. So why shouldn't they give us the superior hog?

We need more promotion to sell lean meat from No. 1 hogs. What we have from the National Livestock and Meat Board and the American Meat Institute is good, but it is too little. The American Dairy Association is showing the way for dairy products. The dairyman, through deductions from milk marketed, is raising the funds for promotion. The swine producer should do the same thing and join with the cattle producer in selling lean meat to the consumers of this country.

A modified improved marketing system reflecting real values and paying differentials for No. 1, 2, and 3 hogs is needed now. A system that will recognize, develop identity, and identify new and superior strains of seed stock and provide a stepped-up promotion program for pork will give the hog producers what is needed.

CURRENT RESEARCH ON CONSUMER PREFERENCES FOR MEAT QUALITY

Harold M. Riley, Department of Agricultural Economics, Michigan State University

Most of us would agree that the procedures for marketing livestock and meat products should accurately reflect consumer preferences back to the farmer through a system of price differentials. Under such a system, livestock that dress out "higher quality" meat cuts should command a price premium over the animals producing cuts less desired by consumers. Given the price differentials on live animals, the farmer then attempts to produce the kind of meat animal which will yield the greatest net profit. If the farmer finds it more profitable to produce fat hogs, he will produce them even though evidence may clearly indicate that consumers will pay a premium for leaner pork cuts.

Our problem then divides itself into at least 3 areas: These are:

1. What are the differences in "meat quality" that consumers can distinguish?

2. How strong are their preferences, in terms of willingness to pay a higher price, to get the preferred product?

3. What changes in marketing practices are needed in order to get marketing firms better to reflect consumer preferences back to farmers as price differentials for live animals?

Currently there are several agricultural experiment stations and various other private and public agencies carrying on research dealing with the problems stated above. I will briefly summarize some of the work with meat retailers and touch on a few of the consumer preference studies.

Meat Retailing Research

The North Central Livestock Marketing Research Committee, recently has published a bulletin "Retailing Meats in the North Central States." (1) 3/ This bulletin summarizes the methods and practices followed by 1,351 retail food stores handling fresh meats. At the time of the survey (May 1953), about 60 percent of the beef handled by these stores was U. S. graded, 35 percent was packer branded, and 5 percent was not branded or graded. Fresh pork cuts were neither graded nor branded, while cured pork items usually carried a packer brand or store label.

Most of the larger retailing firms follow a practice of merchandising only one grade or brand of beef. This quality level tends to be closely adhered to regardless of changes in relative market supplies and prices among the different grades.

Under these retailing practices a question arises as to what extent consumers can express freely their preferences for meat at retail. If the store, or stores, which are convenient to a particular consumer carry only U. S. Choice beef, the consumer may buy this grade even though she would prefer lower grade cuts at the price differentials which prevail in the market. In a similar way consumers may often be unable to express fully their preference for lean pork cuts if the store does a poor job of trimming their retail cuts and/or makes little effort to discriminate against fat cuts in wholesale purchasing.

There is always considerable interest in the flexibility of retail meat prices. The North Central Livestock Marketing Research Committee has made a study of wholesale and retail meat prices. These data are now being analyzed to determine the extent to which retailers adjust their prices as wholesale costs change.

Through such research it is hoped that suggestions can be made that will enable retailers to do a better job of reflecting consumer preferences for meats back to wholesalers and processors.

3/ Numbers in parentheses refer to "Literature Cited," p.64.

Consumer Preferences for Meat Quality

Over the years a system of classifying and grading meats has been developed. These classes and grades are widely used in the wholesale trade as a basis for quoting prices. The use of both packer grades and Government grades for beef, veal, and lamb carcasses date back several decades. Only in recent years has a system of Government grades for pork carcasses been established.

One of the fundamental considerations in classifying and grading meats is that there probably are differences in eating qualities which consumers can identify. The specifications for the various grades are based largely on such things as conformation, amount and distribution of fat, and "quality" as appraised subjectively by a trained grader. The new pork carcass grades are based to a large extent on leanness, which can be estimated objectively by measuring the thickness of backfat and the length of the carcass. A question arises as to whether these grading procedures are closely correlated to the eating characteristics that consumers can identify and are willing to pay for in the retail store.

Currently there are several experiment station research projects underway that have as an objective the appraisal of the adequacy of present Government grades on beef. The University of Missouri has reported some interesting results from their consumer studies on beef preferences. (2) A total of 1,500 consumers were interviewed in 15 St. Louis retail stores. These consumers were confronted with a display of retail beef cuts that were not identified as to grade. Each display contained a loin steak and a chuck roast from carcasses representing each of the U. S. Grades: Prime, Choice, Good, and Commercial. All cuts were from the same position on the loin or chuck, were cut to the same thickness, and were from the same weight of cattle. External fat on these steaks was trimmed until not more than one-half inch remained; roasts were trimmed to one-inch maximum external fat. Consumers were asked to make their choices as to which of the 4 grades they would buy, assuming the prices were the same per pound. Bear in mind that these choices were based on visual inspection. Here are the results:

U. S. Grade	Steaks Percent	Roasts Percent
Prime	31.7	26.8
Choice	24.3	19.9
Good	21.9	27.7
Commercial	15.4	16.7
No preference	6.7	8.9
	100.0	100.0

How do we interpret these results? Nearly one-half of the consumers said they preferred either Good or Commercial chuck roasts when sold at the same price as Choice or Prime roasts. It would appear that leanness was an important factor affecting their preference.

When quizzed about the factors they considered to be most important in judging eating characteristics of cooked beef, these consumers mentioned tenderness most frequently. Flavor was next in importance.

The work on beef is being continued at Missouri. Currently research workers there are running a series of taste tests to determine whether consumers can consistently discriminate between cooked steaks representing different Government grades and weight classes within grades. No conclusive results are yet available from this study, but in early tests the inability of panel members consistently to discriminate between steaks representing different U. S. grades was rather surprising.

The Army Quartermaster Corps has conducted similar taste tests on veal and more recently on beef. Here, of course, the objective is to determine whether the Quartermaster can satisfy men in the Armed Services with some of the "lower" grades of meat.

Several of the States in the Western region are conducting consumer preference research for beef. I understand a bulletin has just been released covering their study.

As yet, the results of these beef preference studies are not complete enough to support any strong recommendations for changes in our present U. S. grades for beef. However, evidence thus far, at least, suggests this is a fertile field for further research. Maybe the grading factors need to be reshuffled. Perhaps the average consumer is unable to discriminate between different grades and cuts of cattle.

I'm sure we are all acquainted with the grading problem in pork marketing. Here, of course, the degree of fatness has become extremely important as a grading factor. A set of U. S. grades for pork carcasses has been drawn up based on extensive cut-out tests.

In revising pork grades it is important to know where consumers begin to discriminate between pork cuts exhibiting varying degrees of fatness. Does our present U. S. No. 1 grade exclude too many lean hogs?

In a study by the Oregon Station in 1950, consumer preference for leaner cuts of pork was borne out by a survey of households. (3) Homemakers were confronted with samples representing pork cuts showing 3 degrees of fatness. Almost without exception the fat cuts of bacon and pork chops were in the last choice position.

A year ago Missouri released a bulletin entitled, "Fatness of Pork in Relation to Consumer Preference." (4) In this study they asked homemakers not only to state their preferences for raw pork cuts but also to home-cook samples from different U. S. grades and to rate them. The basic comparison was between Choice No. 1 and Medium grade cuts of bacon, ham, and chops.

The major conclusion was that the respondents preferred pork leaner than specified in the Choice No. 1 grade. At equal prices per pound, the Medium

grade bacon and chops were preferred by 55 percent of the respondents. Another observation was that a large percentage of the people changed their rating between the before-cooking test and the after-cooking test. The work on pork is being continued at the Missouri Station. It is being carried on cooperatively by the Departments of Animal Husbandry, Agricultural Economics, and Home Economics.

Several other States are now conducting similar research studies on consumer preferences for pork. Pennsylvania State University has a study underway from which research people hope to determine the price differentials consumers are willing to pay between pork cuts from leaner and fatter grades of pork carcasses. The research also will determine the rate of movement of pork cuts from different grades of pork at varying price differentials. This information will be analyzed to appraise the price consequences for carcass and live grades of hogs when differentials are paid for pork cuts derived from those grades. The experiments are being conducted in retail stores on pork chops and pork steaks cut from carcasses grading U. S. 1, 2, and 3. Price differentials are varied at regular intervals based on rotational experimental design. In addition to the above tests, pork chops from U. S. 1 and U. S. 3 carcasses were placed in 2 stores with a 10-cent differential throughout the test. Total sales were equally distributed between these 2 grades.

Other States that have active research projects on pork quality include Illinois, Iowa, and Michigan. In all cases the prime objective is to obtain a better indication of the differences in pork quality that consumers can distinguish and the intensity of their preferences expressed in terms of price differentials between "grades" of retail pork cuts. With this information it may be possible to suggest improvements in present grade standards. Once such changes were adopted by the trade, it would seem reasonable to expect that consumer preferences for pork at retail might be reflected back toward the pork producer in terms of price differentials for live hogs having different carcass characteristics.

Summary

Summarizing, there appears to be ample opportunity to improve our present grading procedures in the marketing of livestock. Changes may also be needed in other practices followed by the meat trade in order to establish procedures which will facilitate fuller expression of consumer preferences into our pricing system. Through proper price differentials farmers will be directed toward the production of those types of livestock products that consumers prefer. Let us keep in mind, however, that not all consumers have the same preferences. Some prefer fat beef, while others prefer lean. Similarly, some consumers still prefer fat pork. The price differentials between grades are determined both by the demand for and the supply of each grade. At any given set of price differentials the cost of production will determine the quantity of each grade that will be supplied. In the absence of a price premium for highly finished cattle, producers could not justify producing them for a commercial market.

Literature Cited

1. Retailing Meats in the North Central States, North Central Regional Publication No. 55, published as Station Bulletin 622, Purdue University Agricultural Experiment Station, March 1955.

2. Rhodes, V. J. and E. R. Kiehl, "Are Consumers Getting the Beef They Want?" Journal Series Paper No. 1508, Missouri Agricultural Experiment Station, April 1955.

3. Vrooman, C. W., Consumer Report on Pork Products, Station Bulletin 521, Oregon Agricultural Experiment Station, August 1952.

4. Birmingham, E., et al, Fatness of Pork in Relation to Consumer Preference, Research Bulletin 459, Missouri Agricultural Experiment Station, May 1954.

RECOMMENDATIONS OF WORK GROUP

Clifton B. Cox, Indiana, Chairman
Amos Meyer, Maryland, Secretary
John C. Winter, A.M.S., U.S.D.A., Consultant

Recent research findings indicate that consumers do not want just meat--they want a certain kind of meat. There is some doubt that present grades reflect their desires, but consumers definitely prefer lean pork. They prefer beef from animals weighing between 750 to 1,050 pounds and not baby beef. Therefore, farmers receive almost as many dollars for veal as for baby beef. Lamb has not increased in popularity, perhaps due partly to the increase in weight of lambs being sold.

There has been a shift in some retail stores to handling more than one grade of beef. In the future consumers may have a choice in grades within one store, as well as a choice in stores.

Meat-type hogs can be produced at the same cost or less than No. 3 or fat-type hogs. Research has proved that No. 1 hogs will actually attain the same weight during the same length of time as No. 3 hogs, with less feed, with a higher percentage of total carcass weight in the 4 primal cuts, and with a lower percentage of total fat for lard.

Do we want to satisfy the consumer or force her to take what the farmer produces? Is it important for the livestock producer to know what the consumer wants? How are we going to approach this problem of quality maintenance and grading of livestock?

After considering recent research results and the best marketing practices, the work group concluded that marketing service people can help in this field along the following lines of work:

1. Inaugurating a program that will value hogs according to the value of cuts or yield. This program will mean changing to a live-grade basis of selling, or perhaps a grade and yield basis.

2. Giving the consumer what she wants--meat-type hogs; lean, tender, flavorful beef; and small cuts of lamb.

3. Reflecting consumers' desires quickly to producers through better pricing efficiency.

4. Promoting a greater demand for meat and meat products through advertising and education. Some consideration may be given to commercial advertising, but a sound program of education should be provided.

DOES DISTRIBUTION COST TOO MUCH?

Omer W. Herrmann, Deputy Administrator
Marketing Research and Statistics
Agricultural Marketing Service
U. S. Department of Agriculture

Consumers last year spent about 75 billion dollars for goods that came mostly from farm crops. Of that amount about 25 billion dollars went to farmers. The other two-thirds, or about 50 billion dollars, went to the marketing system. In the case of food alone the marketing bill in 1955 is estimated at 28 billion dollars, 44 percent more than the 1947-49 average.

Much of the food marketing bill is in the distribution system that starts at the farmer's gate. Before it reaches the consumer, the raw material produced by the farmer is often processed. It may be milled or butchered. It may be frozen or canned. It may be handled with special care and techniques in fresh form. It may be packaged at any one of several points. It may be stored at an assembly point, in a wholesale warehouse, or in a retail establishment. It may be shelved and priced in any one of a number of ways at the retail level, finally to be checked out through a cashier.

It is in this area of distribution that we have more recently been doing much of our marketing research. This is one of our areas of hope, the area in which we seek for increased efficiency in processing, packaging and physical handling, in quality maintenance, in management functions, in merchandising, in other things that affect marketing costs.

Generally speaking, the more processing that goes into a product, the more it will cost the consumer. In 1953, for example, 78 cents of the food dollar spent for bakery and cereal products, went to the marketing system, and only 22 cents to the farmer. On the other hand, 69 cents of the food dollar spent for poultry and eggs went to the farmer, and only 31 cents to the marketing system. More of the food dollar ordinarily goes to the marketing system for highly perishable than nonperishable food products. In the case of fruits and vegetables (still using 1953 figures) 70 cents went to the marketing system and 30 cents to the farmer.

Why does distribution cost so much? There are a thousand and one causes. All of us can recite a number of them. I doubt that any one of us knows them all. Let me review a few of them rather generally.

In the United States we generally grow food where it can be produced most efficiently. Then we carry it to where it is eaten. This method frequently means carrying it long distances. It costs money to carry it. The food travels by truck and by rail, sometimes by water. It may often, at one stage or another of its journey, travel by all three. How far a product has to be transported has weight in the marketing cost figure. Marketing researchers found in 1950 that the transportation cost was about $1.08 per box on apples coming from the Pacific Northwest into the Pittsburgh market, but only about 10 cents per box for nearby Appalachian apples during the same period.

In its travel between farmer and consumer the food is frequently picked up and set down. For some of it, approximately half the labor cost involved in its distribution is for the labor involved in physically picking it up and setting it down. In some cases the product may actually be picked up and set down, by hand, as often as 25 to 30 times. And a little cost is added to the final bill each time the product is handled.

Much of this handling is due to the shifting of our population that has taken place in the last few decades. Population centers have shifted. More farm people have moved to the city. More city people have moved to the suburbs. All of them demand a varied, well-rounded diet every day in the year. With this shifting of people, and with the increased demand for the same foods the year round have come more demands on the distribution system. More people are employed in the distribution system to meet these demands.

There are those who say this demand for increasing service started with the wrapped loaf of bread. That may or may not be. With whatever it started, the demand for services is here. Consumers do want much of their food packaged. This means more than packaging that keeps the product clean. It means attractive packages, packages of different sizes to meet the need of the large family and the small family. In many instances it means packages that allow the retail shopper to see the contents. Packaging of food products occurs at all stages of distribution.

Consumers want services other than packaging. With more people employed, at higher wages, consumers want the distribution system to perform many of the services that used to be performed in the home. They want their breakfast orange juice prepared for them. They want the ingredients for their cakes and pancakes premixed. They want rolls ready to tuck in the oven for just a few moments before serving. They want their poultry and turkeys ready for the oven, or cut up for the skillet. An increasing number of people apparently want whole dinners frozen or canned, ready to serve after only a little heating.

A Department of Agriculture study, using 1953 prices, showed that a homemaker could prepare the meals for a family of four persons for one day in 5.5 hours at a cost of $4.90 if all the foods she used were prepared in her own kitchen. Comparable meals, using ready-to-serve foods, cost $6.70, but took

only 1.6 hours to prepare. Many homemakers availed themselves of the time saving ready-to-serve foods even though they cost more.

Institutional feeders also want more services. Increasingly they are demanding peeled potatoes, frozen french fries, prepared soups, sauces, and other items that reduce their own labor.

Consumers also want high quality in fresh produce. The distribution system has developed facilities that can move fresh produce swiftly under refrigeration or in heated facilities, according to need, to satisfy this demand. It has developed methods and techniques that preserve quality in the produce from the field to the market display counter.

Moreover, the consumer wants to shop in brightly lighted modern stores. She wants to select her day's purchases from 3,500 to 4,000 display items instead of the 1,200 to 1,500 items that appeared in grocery stores 10 years ago. She wants the food products where she can get at them in a hurry, and she wants to see what she is buying. She wants to shop in a store that is air-conditioned, and she needs parking space. Often she wants to shop in delicatessens, or in shops specializing in "fancy groceries," for specialty items. More frequently than in years gone by, she wants to eat away from home, in restaurants.

All these services and many more the distribution system furnishes--at a price.

Is this price too high? Does distribution cost too much?

I believe it is fair to say that distribution costs too much whenever an operation costs more than it needs to cost. That, pretty much, is what we seek to learn through our marketing research--places in the distribution system where operations cost too much. Then we try to see what can be done about making the operation more efficient. In some places we can point to progress. For instance, average hourly earnings of workers in food marketing firms increased 51 percent from 1947 to 1954. But labor costs per unit of product handled--because of improved efficiency--increased only 39 percent during the same period.

In some instances it is not hard to locate inefficiencies. This is true, for example, in the case of some of our terminal produce markets. In many of these even a layman is struck by antiquated handling methods, inadequate storage and refrigeration space, excessive waste and spoilage, inefficient use of labor. The problem here is one of attempting to use horse-and-buggy facilities in a machine age. In these cases distribution does cost too much.

Marketing research can help find answers for this problem. It has come up with plans for remodeling existing facilities where it has appeared practical. In other cases marketing research has developed designs for new and modern facilities, and for the relocation of the new terminal markets. You people are familiar with this work.

In other phases of distribution conclusions are not always so apparent. There is the matter of receiving goods at storage houses. This is an operation

that has historically employed a considerable amount of hand labor. Work simplification studies have shown how some of this labor cost can be eliminated. A lot of our marketing research in this field has been done in California and the State of Washington, with apples and pears. But the principles established in studies of receiving deciduous fruit at storage houses proved applicable to the movement of boxed and crated merchandise in wholesale grocery houses.

In one typical potato storage in East Grand Forks, Minnesota, the substitution of flumes for conveyors permitted one man to perform the duties previously performed by a 5-man crew. A vertical elevator was developed at the Red River Valley Potato Research Center to elevate potatoes from deep bin storages to above-ground packing rooms. When used in connection with flumes or horizontal conveyors, this elevator eliminates all labor required for transporting potatoes from the deep bin storages to the washer in the above-ground packing room.

Something as simple as crosswise loading of watermelons in the car, instead of the traditional lengthwise loading, has resulted in lowering by 70 percent the losses from transportation damage.

In six modern one-floor wholesale grocery warehouses further studies showed that the number of man-hours required in the warehousing operation can be reduced an average of 13 percent through improved work methods, better utilization of equipment, and balanced work crews. Projected man-hour savings of an additional 8 percent, for a total saving of 21 percent, can be expected after new equipment is installed and in operation, the studies indicate.

Studies of retail food stores have shown that employment of proper methods, equipment, and layout in receiving, checking, price marking, and stocking groceries can increase productivity in these operations from 67 to 87 percent.

Improved layouts achieved through remodeling, plus the adoption of certain improvements in work methods, materials, and equipment, resulted in a net gain in labor productivity of 25 percent in the self-service meat department of retail stores.

Loss due to spoilage increases the cost of distribution. Frequently much of this loss is unnecessary. For instance, a study showed that a majority of plant operations fail to get optimum results from their egg washing equipment simply because they fail to follow manufacturers' instructions.

Surveys of retailers who, with their employees, have taken training courses in the movement and handling of fresh fruits and vegetables estimate that savings from reduced spoilage alone now amount to approximately 5 million dollars a year.

A study conducted in the Southeast showed that farmers there could save 42 million bushels of corn a year by harvesting it early and then shelling, drying, and storing it in tight bins. This type of handling protects the stored corn from spoilage due to moisture and from infestation by insects.

Market research has been developing new techniques and equipment for cooling and ventilating grain by passing air through wheat. This method is a complete reversal of the accepted principle of passing the wheat through air. The air drawn through the grain mass by fans has successfully cooled grain and eliminated surface damage. The technique of achieving adequate circulation of air throughout masses of grain has been adapted to grain stored in bins on farms and on Commodity Credit Corporation bin sites, and to grain stored aboard ships and in commercial elevators.

This mechanical aeration has been successful in cooling wheat in silo-type storages, with grain 150 feet deep, at a cost of only about 40 percent that of the turning technique.

Recent tests also have demonstrated that fumigants can be uniformly distributed through a mass of grain by adapting mechanical aeration systems so as to recirculate the fumigant. Better distribution permits lowered cost and the use of fumigants not previously widely used for bulk grain. It makes for greater safety, since the grain is fumigated and aerated in a closed system as part of the treatment, higher degree of insect control, complete removal of the fumigant when the treatment is completed, and faster operation. The whole procedure can be completed in 24 to 30 hours.

I could go on citing examples of places in the marketing system where marketing research has discovered that distribution does cost too much. Some of them would be spot items, like the modified icing for California Bartlett pears. Marketing research showed that using less ice permitted the pears to start ripening in transit, and as a result to ripen faster after arrival at the terminal market. Here, besides obtaining better quality, there is a saving of approximately $40 to $60 a car.

I could go into work that has been done in the fields of frozen foods and of packaging. I could go into what marketing research has done in the collection, analysis, and dissemination of market news. But I suspect that your work groups will be covering in detail a great deal more ground than I could hope to cover individually even if I spoke far past my allotted time.

Chiefly, I wanted today to review with you some of the broad reasons why distribution is costly. I wanted to remind you of some of the places along the distribution line where marketing research has found methods and techniques for reducing costs where costs have been found to be greater than they need to be.

Certainly we are a long way yet from knowing all the places in the marketing system where distribution costs too much. If we knew them all, we would not have the pressing need that exists for a continuing, sustained program of marketing research. Nonetheless, we have made good beginnings in many fields.

We are going to continue our work. Those of us in the United States Department of Agriculture, those of us in the States, those of us in private industry—all of us will continue individually and cooperatively to seek out

more places to cut costs. But we must refrain from overselling what marketing research and services can do. We must recognize that the basic trends today are toward consumers demanding and receiving more services.

The trend, therefore, is toward more costs being associated with given dollar value of goods moving off the farm.

We are unlikely to reverse these trends. Our job is largely one of tempering the increases by finding less costly ways of performing services now being provided, and those that are likely to be developed. Much of this work may have to do with functions other than the physical handling cited in so many of the examples I have used today.

We need to be giving further attention to institutional arrangements, to management functions and decisions, to effectiveness of merchandising and advertising procedures, and to regulations affecting marketing costs. Research is appearing on these subjects, too. You can perform a real service by translating research ideas into market applications on the commodities and in the communities or industries in which you work.

If our efforts are to be fruitful, the work cannot stop with the pursuit of the research. It is not enough merely to locate inefficiencies in the marketing system. The inefficiencies must be remedied.

You in the State Departments of Agriculture are in a wonderful position to spread in your States knowledge already accumulated on places in the marketing system where distribution does cost too much. I urge you to take this knowledge and make it available to the people in your States who can use it in their day-to-day operations. Take the findings of market research and apply them to the problems of the marketing system as you find them. Get out and tell your people about the new methods, the new equipment, the cost-cutting practices that have been developed. Help your people to take advantage of the marketing research that has been done. Adapt it to your peculiar conditions. I hope your workshop discussions will be helpful in pointing out ways that this work can be done.

Although our distribution system is without doubt the best in the world today, it can be made better, and it can be made to operate more efficiently and at a lower cost.

HOW RESEARCH RESULTS CAN BE USED TO REDUCE MARKETING COSTS

Max E. Brunk, Department of Agricultural
Economics, Cornell University

There can be little question but that much of the improvement in agricultural marketing efficiency that this country has experienced is the direct result of our publicly supported research, extension, and service activities. Compared with any other society in the world, twentieth century advancement in American agricultural production and marketing is nothing short

of phenomenal. I do not mean to imply that all our improvements have stemmed from research or that we have taken the maximum advantage of our research findings. But I do submit that much of America's leadership in per capita productivity has been made possible through our public support of the allied activities—research, extension and service.

While all of us assembled here are capable of listing achievements and giving examples of the effective application of research findings, our real concern is how we can use our public trust and resources to still greater advantage. Consequently I am placed in the position of criticizing the best mechanism the world has ever witnessed for transforming research results into applied marketing efficiency. Yet we all know that our marketing institutions do not take full advantage of research findings. If we can succeed in uncovering just a few of the reasons for this situation we should be able to do a little better job in our own respective fields.

If sometime you are looking for a little mental stimulation, you might try drawing up a list of some of the barriers which lie between research findings and their application. The list grows with surprising rapidity, but frustration sets in when you attempt to categorize the items and arrange them in some logical order. On the side of management reasons range all the way from inertia to change to fairly complex problems of capital investment. On the side of the specialist reasons range from problem selection to the organizational structure of our disciplines. Some problems are trivial, while others, such as some legal barriers, appear insurmountable. For purposes of this paper I have culled my list to the best of my ability touching on only those points particularly appropriate to this workshop.

Selecting Practical Research Problems

Probably the most serious impediment in getting trade adoption of research results lies in the original selection of the research activity. Not only is it important that the problem be practical but also it should be timely.

It may seem strange to those in service or extension work that it is not an easy task for many of our researchers to select practical, down-to-earth problems. Unfortunately many of our researchers are isolated from the reality of the marketing world and are inclined to spend their time and resources on problems trivial to the real issues. Many are inclined to attack marketing problems which are entirely too broad in scope for the resources at hand. They are prone to seek revolutionary instead of evolutionary improvements. As a result their findings are often so sweeping in nature that there can be no hope of using them in practical remedial actions. The recipient throws up his hands in horror, and the researcher throws down his pencil in disgust.

I believe that a disproportionate share of such research comes out of our universities although others are not altogether innocent. Too many of our researchers are isolated from contact with marketing institutions or with extension or service people working with those for whom the research is designed. Those in extension and service work can do much to reduce the incidence of the

ivory tower reasearcher by voluntarily offering counsel and guidance to such workers.

We shall always have a shortage of researchers who have new and productive ideas. There is a great tendency to follow the lead of others with the result that we have many people in different agencies and institutions repeating or only slightly varying the approaches of others. Again more intellectual intercourse among research and service people and less with fellow workers would serve to minimize this needless duplicity of effort.

There are many criteria useful in selecting appropriate research projects. I have always found the personal ideas of leading farmers and businessmen of great value in identifying problems of a broad nature, but, because of their limited knowledge of research, they are of less value in isolating fundamental problem areas. The latter can be more clearly formulated by extension and service people who have the interest and ability to filter out the really meaningful problems.

Researchers tend to devote their attention to marketing problems which represent relatively high marketing margins and thereby neglect some of the less spectacular but more rewarding areas. Variations in costs among firms is a far better indicator of opportunities for contributing to cost reduction than is the magnitude of the cost itself. The information we have on marketing margins would be of much more value if we knew variations in cost for the various components.

The final criteria I would like to mention ties in with my point on selecting timely problems. The research process takes time—often years—and it is a rare individual indeed who can forecast the interests or needs of marketing institutions 1, 2 and 5 years ahead. The pressures for research commonly come from those in economic distress. While some distress areas can be forecast well in advance, they still may not be fertile areas for research particularly if they are victims of technological advance. Research effort which "rides with the trend" or preferably ahead of the trend is far more likely to be of value in contributing to cost reduction. All of our marketing problems are dynamic. In getting useful information we should be more concerned with sampling in time than with sampling in space. Too often researchers concern themselves with getting representative samples of existing institutions when they would contribute much more to cost reduction if they would limit their observations to those of typical organizations which appear to be making for the "representative" firm 5 or 10 years from now.

More Teamwork in Research, Extension, and Service

Let us not be too critical of those researchers who operate in the so-called ivory towers. Their isolation is not so much their fault as it is the fault of our system. This system places some men in research, others in extension, and still others in service agencies, and then, as if to insure their respective isolation, it places them in separate administrative organizations. Thus free from distracting influences, each can specialize in his own

chosen field. I presume that this division of labor is supposed to enable each specialist to become more productive. I seriously question that it does. I do not subscribe to the common belief that certain people can do effective research or effective extension to the exclusion of the other, any more than to the absurd idea that regulatory bodies or service agencies cannot do effective research. Much potential research power has withered on the vine for lack of practical nutrients, and much good research has fallen into oblivion merely because there was no effective instrument of communication.

We are not likely to get very far in integrating this highly fragmented research-extension-service mechanism of ours even though we are all working for the same stockholders. Most administrators will probably continue to insist that their men be kept "pure." Those who do attempt to cross lines will be severely criticized for trespassing another's territory. While the United States Department of Agriculture recently has done much to promote greater cooperation between agencies and institutions--sometimes to the detriment of its own program--even so most coordination of effort must come from the workers themselves. Workshops such as this one offer an opportunity to lay aside some of our provincialism and to set our common goals in order.

Service to the Firm

I fear that too many of us in our research and service work are concerned with who gets the benefits of cost reductions resulting from our activities. Regardless of our concern, this is a matter that will remain very largely outside our control to be resolved only in the working of our free market. But this concern can divert our efforts and influence the effectiveness of our work with any one marketing institution.

To make our greatest contribution, the attitude we must take is one of increasing the efficiency of the marketing agency with which we are working. If we go into a grocery store to do studies of efficiency for the sole purpose of helping the farmer or the consumer, we are not going to experience much success with either our research or service. Our immediate purpose in working with such agencies must be to increase the efficiency of that agency so that it can profit by it. Whether or not we like it, we must leave it to competition to distribute the shares of saving among farmers, handlers, and consumers.

We frequently hear the criticism that research, extension, and service people tend to work with the larger and more progressive farmers and marketing firms, thus giving these groups added advantages over that which they already enjoy. It is probably true that a disproportionate share of our effort is so directed. Certainly such criticism is justified <u>if</u> it is the function of research, extension, and service to bring about more equitable distribution of wealth and opportunity. But I submit that such criticism is not justified if it is our function to bring about the maximum efficiency of our marketing functions. We tend to work with advantaged firms simply because from experience we have found that they are the ones which lead the pack in taking advantage of research discovery. But this need not particularly disturb us because working with such firms will often give us our most direct approach to the small operator.

In a recent merchandising study it was found that volume of sales could be increased if a certain practice was followed. What was the most expeditious way of getting widespread adoption? We turned to the largest food retailer in the Nation. At first this retailer was skeptical of the advantage of the new practice but was willing to give it a trial in a limited number of stores. The trial proved out, and the firm soon extended the practice to all its stores. In only a matter of weeks the practice spread rapidly to the stores of smaller firms. Quite intentionally we were able to use the "pace setters" to advantage in bringing about general acceptance of the practice.

Every man in this room is acquainted with the continuing success that our good friend Bill Crow has had in helping to bring about improved terminal market facilities in cities from coast to coast. While it is true that a perfect job was not done in all cities and that not all his efforts bore fruit, how far would he have gotten with this program had he ignored local agencies or had he waded into a pack of wholesalers with an axe to grind for the producer? Looking back on the program, we can see that the interests of the wholesaler had to be served but that in the final analysis it was really more to the benefit of producers and consumers.

Conflicting Interests

There are many conflicting interests at play in our marketing mechanism which not only serve to limit the adoption of research results but also influence the direction of research effort. While some of these conflicting interests are reconciled by informal ground rules, others have led to legislation. The desire to protect home industries or the status quo often overshadows economic advantage and prevents the adoption of cost reducing practices.

Widely recognized are the diseconomies associated with restricted supply areas in the fluid milk industry, plant quarantine restrictions, grade labeling of shipped-in products, transportation barriers, unfair trade laws, restrictive licensing, etc. Some of us in service work are charged with the enforcement of these regulations, and whether or not we agree with them, it is our responsibility to see that they are enforced.

Some of us in research have not been so wise. We have made the mistake of advocating either the adoption or elimination of such barriers and found ourselves in needless controversy. It is not the researcher's job to select ends for society. Rather, I submit, it is his job to inform society of the physical, economic, or social consequences of following a given course of action. Staying within this bound will save him much grief, add to his stature, and enhance his value to society.

Many of the conflicting interests which prevent the adoption of efficient market practices lie not in legal barriers but in institutional management. Management's reluctance to adopt progressive practices may stem from many sources, including monopolistic agreements, internal corporate politics, or some vague thing which, because we cannot identify it, we are inclined to call inertia to change. The important thing to recognize is that we must work with management

in the conduct of our research. There are not many really worthwhile, practical marketing problems that can be attacked in the isolation of a laboratory. We need not only the consent but also the enthusiastic participation of management if we are to make our research pay off greater dividends in the future.

Enlisting the enthusiastic support of management is no easy task. In general the researcher finds this task to be one of his greatest challenges. This appears to be true particularly of successful management. It is much more difficult to argue with success than distress. In some instances management accepts its success as evidence that no changes are needed. I recall all too vividly my experience a number of years ago in approaching the management of the largest and most successful celery packer in the United States. On introduction I explained that I desired to make a study of the harvesting and packing efficiency of his firm. His reaction was disclosed in his first question: "Have you ever grown or packed celery?" Fortunately my limited methods-engineering training has equipped me with a stock answer. My reply was to the effect that my very lack of experience in this area was perhaps my greatest asset in searching for improved method. I did not know a lot of things that could not be done. At least this argument got me in the door, but even so the expert approach of this psuedo-engineering did not generate much enthusiasm. While many inefficiencies were found, each was met with a reason. We continued our struggles and eventually more or less stumbled onto the point that secured the confidence and enthusiastic cooperation of management--comparative costs. This research led to the mechanical harvesting and packing of celery. It not only greatly reduced costs but also put a fresher product in the consumers' hands.

I use this example to illustrate the importance of gaining the confidence of management. In this instance we nearly bungled the job. Certainly much sound research has gone for naught simply because of failure in this area. All specialists--research, extension, and service people--could greatly enhance the value of their work by more carefully cultivating management. A careful job in this area would serve to eliminate a most formidable barrier to the adoption of research results.

Merchandising our Research

In order to do an effective job of reducing costs in marketing, we must learn to communicate our research results to others. Researchers in general do a poor job in preparing their wares for consumption. They tend to cloud their findings with irrelevancies and qualifications. Many of the gems of our marketing research are buried in long and boresome tomes. The researcher needs the help of extension and service people in preparing research findings for market. The more it can be culled, cleaned, and prepackaged, the greater will be its acceptance.

Even though the pride of ownership or authorship is often the driving force behind much research, it is probably one of our most serious deterrents in effectively merchandising our work. Researchers are sometimes reluctant to permit others to pick up the merchandising job with a free hand. At the same time extension and service people are inclined to take only passive interest

in research effort in which they have not participated. Once again the solution to this problem seems to rest in a closer integration of our research, extension, and service work.

At the risk of overemphasizing my point I would like to make a lengthy quote from the writings of an extension specialist. I prefer to use his words because they bring out the attitude of the extension specialist in carrying out his part of an integrated program. He is reporting on research which was done under my direction. I use it only because I am thoroughly acquainted with the case. I quote:

"Leading apple growers, influenced by falling consumption of apples, low prices and rising production costs, developed a strong interest in improving the marketing of their product. The work of extension specialists helped to focus attention on the product as offered in retail stores, its quality and merchandising practices used. Research and extension specialists in marketing discussed the problem with growers individually and through their organization. A marketing economist decided on a program of research after becoming personally acquainted with the situation, analyzing the problems, deciding that there were good possibilities for accomplishing beneficial results, and obtaining full cooperation of the producers' organization.

"Greater integration of effort occurred after the researchers obtained positive results in the fall of 1950--results indicating possibilities for increased apple sales if retailers would adopt certain merchandising practices. These results were first reported to growers during January 1951. The researcher's report, presented in a most enthusiastic and effective manner, encouraged a few growers to persuade the retailers they served to use these merchandising practices. Some accepted the results with skepticism pointing out that the research was conducted in a limited number of stores.

"The extension marketing specialist, recognizing the research results as offering opportunities for improving the efficiency of apple marketing, undertook a program to secure use of these results by the retail trade. A stuffer summarizing the research results on one small sheet was prepared and 100,000 copies were placed in apple boxes by producers. Articles were prepared for farm and retail trade publications. At the same time research continued, as experiments were conducted in other cities and other chains to answer questions left unanswered the first year.

"The extension specialist prepared and distributed a folder presenting the research results to store management, distributed the research results to package and equipment manufacturers, conferred personally with the management of most chain companies with stores in the State, discussed the research with county meetings of growers and local groups of retailers, prepared articles for radio, the popular press and publications of the retail trade, and discussed the work with specialists in other States. He also prepared a set of colored slides

and notes for a talk on apple merchandising that was distributed to chain companies and extension workers. In the fall of 1952, when apple prices were higher the research and extension specialists pooled their resources to recheck the results under the new price conditions. Also that year, when retailers in a large city were slow to adopt the new practices, the extension specialist conducted a demonstration in chainstores there.

"The marketing research specialist too was active in extension of the research results, discussing the work with producer and retailer groups on a national level and in States from coast to coast. Assistance and advice was provided by both specialists to growers and retailers and both worked closely with the producer organizations encouraging them to help obtain improved merchandising.

"This combination of effort in an integrated program contributed importantly to a widespread application of the research results and benefits to producers, retailers, and consumers. The extension specialists became familiar with and enthusiastic about the research results by assuming responsibility for certain phases as a part of demonstrations. All those associated with the work derived considerable satisfaction from tangible accomplishment.

"This integration of effort, fostered by an administration that gives considerable individual freedom yet encourages close working relationships, was possible because of individuals with a common recognition of the importance of an industry problem and a mutual respect and confidence between workers, evidenced by a willingness of the researcher to entrust the extension specialist to share in the researcher's burden." 4/

There are, without question, many other illustrations of how specialists have done an effective job of merchandising research results by integrating their efforts. It is much easier to do this within the framework of a given institution even though the specialists may be operating under separate administrations. Teamwork between agencies politically and geographically separated offers more of a challenge to lay aside harmful provincialism.

You have no doubt now recognized that I have found the title of my talk unmanageable. Marketing is an extremely broad subject, and mere listing of how specific researchers have contributed to cost reductions would be beyond the capacity of any one individual. So I took the easy way out and attempted to identify only a few of the impediments that lie between research and service in the hope that it will enable us to do even a better job than has been done in the past.

4/ Lloyd Davis, "Integration of Programs--A Challenge to Marketing Research and Extension," Journal of Farm Economics, December 1954, pp. 1088-1090.

INCREASING SALES OF DAIRY PRODUCTS

Shelby A. Robert, Jr.,
Market Research Director,
American Dairy Association

It is a pleasure to be with you this morning and discuss the results of research to assist in increasing sales of dairy products. I can visualize the important role which you in the State Departments of Agriculture can play in increasing sales in each of your individual States. Some of the work which is going on in a number of States--notably Wisconsin, Minnesota, Michigan, and New York, to mention a few--has been of such value that it is rather presumptuous for me to discuss anything other than research before this group.

I would first like to correct a misconception which I seem to get from the program. As I understand, we are to discuss "the possibilities of solving dairy surplus problems by increasing the sales of dairy products." I must indicate that we feel we have increased sales of dairy products, that this increase in sales has assisted in solving some of the problem which we have had with various dairy surpluses in the last few years, and that the possibility for further increasing consumption is good. I would like to discuss this subject in a little more detail in a few minutes.

Before discussing the research which we have been conducting in the American Dairy Association and summarizing some of the research which has been done in the U. S. Department of Agriculture and in some of the colleges, I would like us to delineate what marketing research can do. Research cannot sell more dairy products, nor can research accomplish anything else by itself. I am glad that this is true because it indicates one of the principles of our competitive economy which is important to all of us. It means that research results cannot be forced on anyone. It means that research must be designed to fit the needs of a using industry. It must be designed to fit the needs, in this case, of manufacturers, producers, dealers, and distributors--all of whom are anxious to make additional profit. If research results will assist them in accomplishing this goal of additional profits, the results will be put into effect, if they will not, the research results then lie idle and are not used.

The research, to be of value, must indicate one of two things: (1) How to sell more, or (2) how to reduce costs. Max Brunk has discussed with you how research results can be used to reduce marketing costs, which is one side of the balance of profits. In the few minutes available, I will try to tell you something of the research which can be used in increasing volume of sales, which is the other side of the balance for the individual producer, manufacturer, or distributor.

Research in the American Dairy Association

Our business in the American Dairy Association is advertising, merchandising, public relations, and research for all dairy products--fluid milk, butter, cheese, nonfat solids, evaporated milk, and ice cream. In order to carry out a successful advertising program, the advertising and merchandising

must be based on facts. For this reason, the American Dairy Association two and a half years ago embarked on a program of marketing research to provide the facts necessary to design a successful advertising and merchandising program. The research which we undertake, however, goes much further. It does, of course, provide us with the information which we need to plan our program, to spend our advertising and merchandising dollars more wisely, and to give us more assurance of placing our efforts in the right direction. In addition, our research provides the entire industry with additional information about its customers. The first need in expanding the consumption of any commodity is a description of its customers: Who they are, where they are, what they do, and what kind of consumption habits they have concerning the particular products in which we are interested--in this case dairy products. Not only have we embarked on a program of marketing research of our own, but in addition we have cooperated with the U. S. Department of Agriculture and a number of the colleges in expanding marketing research on dairy products.

We have, in the last two and a half years, published four reports on as many studies of consumers' attitudes toward dairy products. These studies have been conducted for us by Alfred Politz Research, Inc. They have covered each of the major dairy products and have provided us with information helping to plan more effective advertising and merchandising programs. Since it would be impossible to report all of our results, I have selected a few major points to discuss.

On fluid milk, we have learned more about how milk drinking declines with age. Twenty-five percent of our population, those under 15 years of age, consume a little over half of the total fluid milk consumed. The remaining 75 percent of our population consumes the other half. In addition, adults in families with children consume less fluid milk than families without children. This fact indicates that a problem of budgeting the consumption of fluid milk within the family exists. Is there something in this area which we can do to increase the amount of milk consumed among adults? We also have learned that more men than women drink milk--even though almost 80 percent of all consumers drink some milk occasionally, and about 50 percent consume milk on an average day.

Availability is a strong motivating factor in milk drinking. There is very little impulse purchase of milk. Less than 7 percent of our consumers indicate that they purchase milk at retail stores when the purchase is not planned before arriving at the store. Milk drinking represents the largest market for fluid milk. By far the largest proportion of all milk that goes into the household is consumed as fluid milk rather than used in cooking.

What do these findings mean in terms of increasing milk consumption? How can we approach consumers to induce them to consume more milk? There are basically three ways in which we can improve the quantity of fluid milk consumed.

1. We could bring more drinkers into the market. To increase the number of drinkers, however, might be rather difficult because of the fact that such a large proportion of consumers now drink fluid milk.

2. We could induce some consumers to drink more milk at a given occasion. Some work along this line already is being done.

3. We could try to get consumers to drink milk on more occasions. This field is our greatest potential for increasing the consumption of fluid milk.

What about butter? The preference for butter over substitutes is overwhelming--even among those families who say that they never use butter. The prestige element in butter use appears to be the most important factor in butter consumption. Even among those families who say they never use butter, a large proportion indicate that when they have fussy guests, they serve butter. Most of the butter used by consumers is used on the table as a spread. Cooking use suffers. For all cooking purposes, the use of oleomargarine holds up much better than the use of butter. Prestige cooking is an important point to be considered in improving the sale of butter.

There are some weaknesses in butter packaging and in its keeping quality. Consumers generally dislike the present packaging methods. They desire recipes on the carton and other indications of how they might use butter.

What do these considerations mean in terms of improving the market for butter?

1. We can indicate the composition of butter and capitalize on what a good product it is.

2. We can utilize the importance of prestige in butter consumption--both in table use and in cooking. Particularly, we can indicate the kinds of cooking for which butter is well suited and help consumers to think of using butter in these ways.

3. We can improve the package for butter to overcome the criticism which consumers presently have.

Our research indicates that consumers as a whole have very little knowledge of the various varieties of cheese or the uses of these varieties. Cheese is not available in the household enough of the time or in enough households. The attitude consumers have about the use of cheese in meatless meals is that cheese dishes are hard to prepare and that cheese is not as readily available as are vegetables, fish, and eggs. These findings open a number of avenues of approach to increasing the volume of cheese sales. We can assist in improving the impulse purchasing of cheese through providing the consumer with ideas as to how to use cheese. Information about varieties, the use of the various varieties, and the keeping qualities and storage methods can assist considerably.

Additional information is available on these commodities. These are just a few of the highlights of materials which I picked out for discussion. Further, we have learned a great deal from our research about the other major dairy products--ice cream, nonfat solids, and evaporated milk. We also have investigated the whole area of public relations as far as the dairy farmer is concerned. We find that he has very few problems in this regard.

Research in the U. S. Department of Agriculture

Concurrent with the initiation of an expanded program of marketing research in the American Dairy Association, the U. S. Department of Agriculture initiated a program of research designed to assist in selling more dairy products. This program was undertaken in the Market Development Branch of the Agricultural Marketing Service. The Department entered into a contract with the Market Research Corporation of America, partially financed by the American Dairy Association, to report on purchases of butter, nonfat solids, cheese, and oleomargarine. Monthly the Department releases reports on the level of purchases for each of these products and prices paid by consumers. Quarterly, a more detailed analysis of distribution is published by regions and by types of outlets through which the purchases are made, that is, national chainstores, regional chains, independent outlets, and home delivery. Once each year an analysis is made of the characteristics of the purchasers. The reports describe these characteristics in terms of age, education, income, size of city, residence, and a number of other factors which are valuable in terms of describing the market to which we are directing our attention. Generally, these data provide us with useful information on the areas where opportunities are the greatest for selling more of these specific dairy products. In addition, the monthly volume of purchase data gives us a measure of the amount of the various products going into consumption in households. The data do not include the consumption in restaurants, hotels, and the like.

Let us briefly highlight the market situation. The butter market is concentrated most heavily in the Northeast and North Central regions of the country. These two regions account for almost 80 percent of the total consumption of butter in households. We find that younger housewives do not use butter regularly. Older housewives use a larger amount than do younger ones. Butter purchases in September were 5 percent higher than in the same month last year, with an increase of 7 percent in the number of families buying butter.

The cheese market is heaviest in the Northeastern States and in the Pacific Coast area. The characteristics of this market by kinds of cheese are quite different. The Pacific Coast consumes large quantities of natural cheese. Consumption of cottage cheese is much larger in the Pacific region than in the rest of the country. The eastern areas consume large amounts of specialty cheeses and processed cheese.

We have watched the growth, through these data, of the nonfat solids market. The number of families buying during the period April to June 1955 was 23 percent larger than in the same period last year.

Other studies in the Department include merchandising tests designed to discover merchandising practices which will induce consumers to buy more of the specific dairy products tested. Two of these tests have been conducted to date: One on cheese (natural and sharp American cheese) was made in Pittsburgh, Pa., this past year in cooperation with the Kroger Company; and the other, a study on butter, was recently completed in Cleveland, Ohio. In the cheese experiment the type of display, size of package, and prepackaged and store cut were tested.

This test indicated that more cheese can be sold by having larger cuts and by combining prepackaged and store-packaged cheese in the display. A formal or jumbled display had little effect on consumer purchases.

The Department is also studying the effect of milk vending machines on the total consumption of fluid milk. Several studies have indicated that consumers buy milk at vending machines, but little is known of the effect which these sales might have on the total consumption of milk. The Department, in cooperation with the West Virginia Agricultural Experiment Station, has undertaken a study to measure this effect in Martinsburg, W. Va. Plans for additional studies are underway.

Research in the Land-Grant Colleges

The colleges have assisted materially in improving our knowledge of methods of increasing sales of dairy products. A number of the colleges have studied the importance of vending machines in selling more milk. Among these are Utah, Wisconsin, Cornell, and South Carolina. Max Brunk at Cornell has been studying different methods of distribution as a means of increasing milk consumption. Ways of increasing milk consumption in schools have been studied by each of the States in the North Central regional project. Data from the Lansing panel operated by Michigan State indicate some of the possibilities of increasing dairy product consumption in that area.

Summary

What does all of this work add up to? Have the results of the research been put into effect? Has consumption of dairy products increased? Let us look briefly at our position in terms of consumption and surpluses of butter and fluid milk at the present time.

In 1953, per capita consumption of butter was going down and down rapidly. It reached a low point of 8.5 pounds during 1953. In 1954, it was 9.0 pounds, and the estimate for 1955 is 9.3 pounds. The downward trend has been stopped. It has been stopped in the face of tremendous surpluses held by the Commodity Credit Corporation. These stocks, however, have been liquidated to the point where they are about a fourth of what they were a little over a year ago. In fact, the level of stocks held by CCC at the end of October—a little over 100 million pounds—is the lowest amount on hand in over two and a half years. In September only 114,000 pounds were purchased. Therefore, we now are faced with a healthy market. Our stocks in normal trade channels have increased, indicating a feeling on the part of the trade that they can buy during flush seasons for sale during short seasons, thus resuming a normal pattern. These increases in per capita purchases are not the result of any one factor but are a combination of lowered price, welfare and school lunch disposal, and additional purchases on the part of consumers.

The amount of milk going into manufactured products is about 2½ billion pounds less than it was last year. This leaves 2½ billion pounds additional for consumption in the form of fluid milk. The production of milk is a little

higher than it was last year. In fact production during September and October was the highest on record for these months. Sales during August 1955, in the 26 largest Federal order markets, were 7.1 percent more than in August 1954. For the year, sales in these markets are 4.5 percent up from last year. Commodity Credit Corporation purchases of all dairy products are lower than last year by about one-half. Prices paid for fluid milk at the farm level in October were 88 percent of parity while being supported at only 75 percent.

We are selling more dairy products. We can sell even more dairy products. Increased sales of dairy products can assist materially in reducing our surpluses. Research can assist in telling us how to do a better job--this job being to sell more dairy products.

RECOMMENDATIONS OF WORK GROUP

Donald E. Wilkinson, Wisconsin, Chairman
Mancil J. Vinson, Kentucky, Secretary

One of the most important measures that can be taken by marketing service workers on solving dairy surplus problems is expanding the consumption of dairy products. Research indicates that a big potential to absorb the present production now exists.

The committee on increasing sales of dairy products, realizing that a great effort has already been demonstrated, suggested the following areas in which State service agencies, in cooperation with other groups, can efficiently initiate new activities or expand present programs to increase the sale of dairy products:

1. Increased promotional activity on the local, State, and national level is needed to maintain and increase the number of planned and impulse purchases of dairy products. Special promotions for dairy products, as well as a continuous advertising program, are effective for increasing sales. Surveys also reveal that sales remain considerably higher following the intensive effort than they were prior to the campaign. Marketing service workers need to increase their efforts on promoting local and State campaigns involving wide publicity by newspapers, special presented materials and programs for radio and television, and special publicity events.

2. Homemakers need to be better informed on the use of such products as cheese, nonfat dry milk, evaporated milk, etc. Consumer information programs, as well as special promotions by State departments, will be most helpful to inform consumers of the value of those products and of different ways to use them. Mass methods of communication such as newspaper releases, radio, and television programs, as well as many other methods, should not be overlooked.

3. The lack of availability of milk at possible consuming points hinders the expansion of milk sales. Milk should be made accessible at as

many locations as possible. Research on, as well as results from, using milk-vending and bulk-dispenser units have proved that fluid milk sales can be increased and the cost of distribution reduced. Marketing service representatives should promote the use of vending units in offices, factories, schools, and other locations at which a number of potential customers are concentrated. They should also work with vending operators, fluid milk dealers, and vending machine manufacturers to evaluate the sales potential of various locations, availability of supervision, and adequacy of equipment.

4. In many instances the vast amount of valuable material supplied by the American Dairy Association and the National Dairy Council, developed to give nutritional information or increase sales, fails to reach or to be used by the institutions, wholesalers, or retailers for which it was developed. To apply market expansion programs and effectively utilize such material, marketing service representatives should assist these and other agencies on making this information available and include such material in their special campaigns.

5. A promotional program aimed at the hotel and restaurant trade to improve their attitude toward serving and handling milk and other dairy products is needed. Due to the lack of knowledge and interest in the industry, little or no emphasis is given by this group on the use of dairy foods. Regular contacts should be made with restaurant operators and hotel managers to familiarize them with the dairy industry, to secure their cooperation on special campaigns, and to improve the competitive position of milk and other dairy products in their business.

6. Improvement in the types, sizes, and designs of packages and containers is needed to increase impulse sales as well as increase the quantity of dairy products purchased. Service representatives should be familiar with recent improvements along this line and know the availability, costs, and advantages of new containers. Processors will appreciate receiving such information and will be most cooperative on carrying out practices to promote increased sales.

7. A lack of effective point-of-sale advertising is evident in many retail outlets, and improvements in merchandising are needed. Special campaigns and promotions which include these techniques demonstrate their effectiveness. State departments, in cooperation with the Extension Service, should develop training programs for handlers of dairy products similar to the programs now being conducted by the United Merchandising Institute for fruits and vegetables, the Poultry and Egg National Board, and the Meat Institute.

8. In certain instances outlets for surplus dairy products should be developed in nearby deficit areas. This possibility is evidenced by the difficulty school officials in such areas have experienced in setting up the Federal School Milk Program. State department personnel should locate such areas and work with fluid milk suppliers to remedy this situation. One illustration of this possibility is the use of refrigerated

tractor trailers to provide supplies needed where local processing facilities are inadequate. Small refrigerator delivery trucks could load from the trailer and serve many local outlets.

9. The Federal School Milk Program needs to be expanded in many school districts. Marketing service representatives should assist school officials in setting up the program and adapting distribution practices to achieve maximum results.

10. In many instances dairy plants and milk haulers need to improve the efficiency of their operation, which should result in a reduction of retail prices. Experience indicates that lower prices usually increase sales and expand the use of dairy products. Marketing service personnel should study research reports, and advise dairy plant operators on improving existing facilities and haulers on policies and route arrangements to eliminate unnecessary costs.

While applying all these and other methods of increasing sales of dairy products, marketing service agencies should be aware of the opportunity to (1) increase the number of consumers, (2) increase the amount of dairy products used at each consuming point, and (3) increase the number of occasions dairy products are consumed.

REDUCING COSTS OF HANDLING GRAIN

William C. Dachtler, Market Organization and Costs Branch, Marketing Research Division, Agricultural Marketing Service, U.S.D.A.

For our discussion today it may be well to define handling somewhat more broadly than the usual connotation. Let us include all of the activities required to move grain from the time of harvest on the farm to the storage point or points, to condition the grain prior to and during the storage period, and to transport it to the processor or user. Research and experience have established rather conclusively that grain can be handled with little, if any, loss in market grade. Our present knowledge of techniques, facilities, structures, equipment, etc., if properly applied, is sufficient to get a reasonably good job done. The alternative methods which are available, however, require varying proportions of labor time, labor skill, equipment, structures, power, etc., which means that the costs vary widely. Today's research is aimed at methods of moving grain from harvest through market channels without loss of quality at lower cost. I should like to cite several illustrations of work which may contribute to cost reduction and increased efficiency, and Mr. Winter also will comment on phases which relate more specifically to transportation facilities.

Aeration vs. Turning

Yesterday we discussed the possibility of substituting aeration for the customary practice followed by operators of commercial storages of turning or moving grain from one bin to another to cool or equalize grain temperatures.

Advantages were cited and it was indicated that grain quality can be maintained effectively by passing cool air through the grain rather than the grain being passed through the cool air. Today let us compare the costs of these alternative methods. To control variations in grain temperatures which give rise to moisture migration and accumulation within the grain by mechanical aeration requires low rates of airflow (1/50 to 1/10 c.f.m. per bushel). Research studies being carried on in 5 geographical areas show that cooling is effective in storages up to 90,000-bushel capacity with grain depth ranging up to 140 feet. Where individual aeration units were used on each bin, the experimental systems were installed at a cost of from about 1 cent per bushel for deep bin storage of 50,000 to 60,000-bushel capacity to roughly 5 cents per bushel for small storage units of 3,200-bushel capacity. It should be possible to prorate these equipment and installation costs over at least a 10-year period. Annual fixed costs then would amount to from 1/10 to 1/2 cent per bushel. Data obtained from aeration tests to date indicate that power costs range from 1/10 to 1/2 cent per bushel. Therefore, annual ownership and operating cost (exclusive of labor required with manual controls to start and stop the blowers) would range from 2/10 to 1 cent per bushel, or an average of 6/10 of a cent per bushel. From limited research data and estimates of commercial operators, it is estimated that 4 annual turnings generally suggested as a minimum would incur a total cost of from 1/2 to 1-1/2 cents per bushel, or an average of about 1 cent per bushel. On the basis of these estimates, there would be an average annual saving of 4/10 of a cent per bushel for aerating rather than turning grain. AMS stock reports for September 1955 indicate that over 499 million bushels of wheat, corn, and grain sorghums were in commercial storage exclusive of flour mill elevators, crushing plants and other processing facilities. Assuming that about 1/2 of this grain will remain in storage for at least one full season, the potential saving for cooling and conditioning stored grain by use of mechanical aeration rather than by turning would amount to approximately 1 million dollars. We may add to this amount the savings possible from the reduction in grain breakage and damage which occur in the normal turning operation and the ability fully to utilize warehouse capacity as storage space in lieu of reserving a portion as workspace for turning.

Again, we may refer back to yesterday's discussion of the dual use that can be made of aeration systems for recirculation of fumigants, and further add to the reduction in cost because of the lesser quantity of materials needed for insect control which results from recirculation.

Bulk vs. Bag Handling

Throughout most of the commercial grain producing areas of the United States the shift from bag to bulk handling of grain already has taken place. In the southeast, south, and northwest, however, the transition has not yet been completed. So far as I know, only one study has been made recently of the probable savings resulting from the changeover. Mr. Winter will report on this work in a few minutes. However, it certainly is safe to say that the weight of evidence from experience and earlier research favors bulk handling. Within the last year or two, the feed industry has initiated bulk handling of mixed feeds even to the extent of bulk delivery to farm feed lots. The processors of dehydrated alfalfa,

also, are shifting quite rapidly to bulk handling of their product--a considerable portion of which is now pelleted for easier mechanical handling and storing in bulk.

Reductions in cost through bulk handling result chiefly from savings in material and labor expense. Bags are expensive per unit of capacity and have a relatively short service life. Additional labor for filling and emptying is a necessary added expense item. Mechanization of grain movement also is more complicated when bags are used. Additional labor time is required for stacking, loading, transporting, etc. Often relatively simple conveyors suffice for moving bulk grain, i.e., gravity flow, belts, etc. Drying, cooling, fumigation and other conditioning practices are less complex in application to commodities in bulk.

Improved Work Methods and Equipment

Shorter harvest season movements, more elevator storage, and larger trucks create a strong demand for fast receiving capacity at elevators. This trend means faster elevating capacity, larger truck and weighing out scales, and more railway siding. It means wider driveways, larger dump pits, faster truck hoists, and fast convenient truckloading facilities. The handling equipment for each group of operations must be related in capacity to the equipment for other operations and to storage capacity if the greatest efficiency and lower costs are to be obtained. Unless the capacity of each piece of equipment is related to the capacity of every other piece, the equipment with the lowest capacity becomes a bottleneck for the entire system. Conversely, a single piece of equipment with greater capacity than other equipment in the facility contributes to higher cost both because of the larger initial investment required and higher power and other operating charges.

Labor and other costs are such that over half of the total costs of handling and storage are operating or out-of-pocket costs. This situation has stimulated interest in labor-saving devices and a trend to high capacity handling equipment. Hopper bottom bins, which utilize gravity for grain flow and practically eliminate labor time required for emptying the bin, may be justified on a cost basis if the bins are emptied at least 3 times per year. Belt and pneumatic conveyors have a high initial cost but relatively lower upkeep and larger capacity and cause less damage to grain than screw-type conveyors. Hopper scales are faster and more accurate than the commonly used small automatic scales.

More research is needed on labor-saving devices and improved and simpler types of handling equipment. Studies are underway on handling wheat in Kansas and grain sorghums in Texas. Commercial upright and flat-type storages representing significant variables with respect to facility design and size have been selected for studies which include a survey of existing methods and equipment, timing of segments of specific handling operations, preparation of flow charts and diagrams of grain movement and basic information on equipment and equipment installation. Both labor requirements and nonlabor inputs will be determined. Similar work will be carried out at a recently constructed experimental bin site in Illinois to determine more efficient methods and portable

equipment for use by the Commodity Credit Corporation or by commercial storage operators having auxiliary bin storage as adjuncts to elevator enterprises. Methods analysis will be used in improving existing work methods and equipment and in developing plans and working drawings for new handling equipment.

Savings in operating costs also can be made by preventive maintenance. The practice of running machinery and equipment until they break down is costly in time wasted during shutdowns and in expenditures for new parts and repairs. Periodic inspection, lubrication, and adjustment of handling equipment can contribute to lower costs.

Summary

We have touched upon only a few of the possibilities of reducing grain handling costs--more efficient methods and equipment for controlling temperature, moisture, and insect infestations in grain; the advantages of bulk compared with bag handling; and the development of improved work methods and more efficient handling equipment. Mr. Winter will comment on the influence of truck and rail movements and improved transportation facilities for grain. We hope that the general discussion which follows will bring out other pertinent factors which should be considered.

John C. Winter, Transportation and Facilities Branch,
Marketing Research Division, Agricultural
Marketing Service, U.S.D.A.

Transportation by Rail

Mr. Dachtler has mentioned some of the efficiencies that result from handling grain in bulk rather than in bags. Most of the grain transported in this country is, of course, handled in bulk, but there are a few areas remaining where the use of sacks is fairly prevalent. One of these is in connection with the handling and transportation of rice in Louisiana and Texas. We recently have made some study of that situation, comparing the costs of loading and unloading rice in bulk and in sacks, and table 1 shows preliminary figures that compare these costs in terms of man-hours and dollars. In arriving at these data, time and motion studies were made of actual loading and unloading operations. In the upper part of the table are the data pertaining to the loading, showing that rice can be loaded into boxcars or covered hopper cars at only one-fifth of the cost in terms of man-hours and dollars. The difference in unloading costs of sack versus bulk rice is not quite as great, but here again, it costs 4 times as much to unload rice received in sacks as it does if the shipment is made in bulk. The table also contrasts the efficiency of different methods of unloading rice from boxcars and from the covered hopper car.

To my mind, the boxcar falls far short of being a good and efficient vehicle for the transportation of grain. It is a box on wheels that has to be recoopered and graindoors installed to make it grain tight before loading and when it gets to its destination, the grain must be scooped, sucked, or shoveled out, each method being quite costly and time-consuming. I am often asked why suction is

Table 1.--Comparison of loading and unloading rice by various methods

Operation	Sacks (162 pounds) per man-hour	Man-hours per carload (525 sacks) 1/	Labor cost 2/ per carload
			Dollars
Loading sacked rice	35	15	18.75
Loading bulk rice-boxcar	175	3	3.75
Loading bulk rice-hopper car	175	3	3.75
Unloading sacked rice	34	15½	19.37
Unloading bulk rice-boxcar:			
Suction hose	135	4	5.00
Power shovel	120	4½	5.63
Wheeled hand scoop	84	6¼	7.81
Unloading hopper bottom car	210	2	2.50

1/ The bulk rice loaded in boxcars is equivalent to about 525 sacks of 162 pounds each. The normal carload of sacked rice is 420 sacks. For purposes of the comparison of the efficiency of loading and unloading, data on sacked rice and bulk rice in hopper cars were converted to 525 sack equivalents.

2/ At $1.25 per hour.

not used more in unloading grain from boxcars. Part of the answer is here. A number of the mills in Louisiana and Texas have suction hoses for unloading rice from cars, and we found that the operation consumed 4 man-hours at a cost of $5. This record is somewhat better than the one we found on cars unloaded by power shovel, but the original cost of the suction equipment and its installation is quite substantial compared to the rather nominal cost of the power scoop. I understand that the installations in the rice mills cost around $10,000. There are also several other disadvantages. If you want a fast unloading operation, power costs are high. If you cut down the size of the hose and limit the power, the time consumed in unloading is greatly increased. Further, the rapid suction of the grain through the hose is likely to break the kernels. This disadvantage is important in rice where long grains command the premium prices, and the long grain rice is that which is most likely to be fractured in handling. There is one mill in Texas that installed a suction unloader a few years ago. It was used one day and has not been used since because of the breakage.

Furthermore, the hull of the rice contains silica, an abrasive which scores and eventually wears through the hose where it makes turns or goes around corners, and the hoses or ducts need frequent replacement.

The most efficient car of all from the standpoint of unloading is the covered hopper car, which is used quite extensively for rice in Arkansas. It is not generally used for grain because the railroads do not have enough hopper cars for the purpose, and the capacity of the car is somewhat smaller than it should be. Covered hopper cars that have been used for grain and rice were built for cement and other bulk materials. They hold 1,550 to 1,650 bushels of grain, whereas they could and should hold 2,000 bushels.

There are two main reasons why the railroads have not gone into the purchase of covered hopper cars for grain. One is that they cost somewhat more than boxcars, perhaps $1,000 or $2,000 per car. The second is that the railroads feel they can get higher utilization out of the boxcar, which handles a great variety of loads. The hopper car can handle, of course, only the bulk, granular, free-flowing materials.

We are not at all sure that the railroads are correct in their assumption that they get better utilization out of boxcars in grain handling. First, there is a relatively small amount of traffic going out to grain loading stations in the country that would move in boxcars. Second, the ability to unload quickly makes possible a faster turn-around time of cars. In connection with this rice study, we made a survey in cooperation with officials of individual railroads and the Association of American Railroads to see what kind of turn-around was obtained on the cars used for the movement of bulk rice in Arkansas. It was surprisingly good. It was found that in a sample of the cars studied, only 4 days elapsed from the date the car was loaded at the country station until it was reforwarded empty from the milling point. This period, however, represents only one-half of the turn-around time, which also includes the reforwarding of the car back to the country point and placement for loading. In contrast to this unloading record, a study also was made of the detention of almost 3,000 carloads of rough rice at Houston, Tex., in 1954. Those cars averaged slightly more than 4 days from the time they arrived in Houston until they were unloaded. In other words, while in Arkansas the record was 3 days for loading movement and placement and 1 day for unloading, it took the equivalent of that 4 days just for placement and unloading in Houston. This rather surprising development has been of considerable interest to the cooperating railroads, and we are looking forward next year, as soon as a number of 2,000-bushel hopper cars suitable for grain can be built, to making a similar study of their utilization of grain handling as compared with the utilization of boxcars.

Transportation by Truck

One of the significant developments in grain handling in the past few years has been the increase in the movement of grain to market by truck, the growth of the method being the greatest in the Southwest. I have distributed copies of the report on a study which we made back in 1951-52 which you may find of some interest because it goes into not only the relative volume of grain handled by motortruck and railroad but also how it was handled by truck and the reasons why some shippers preferred truck to railroad and vice versa.

Without going into the details of the study, I may say it indicated that approximately 20 percent of all the grain transported in Texas and Oklahoma in 1951 was moved by truck. Some of it followed the conventional channel from the farm to country elevator, to terminal elevator, to mill, but some of it was also moving directly from country elevators to mills, some directly from the farms to terminals, and in some cases directly from the farm to the flour or feed mill.

That this development has some rather serious implications is evidenced by the fact that our Grain Research and Marketing Advisory Committee to the Department gave top priority at its last meeting to a proposal that we make another

and more intensive study than the first. The Committee wants us to develop more facts on the extent of the use of trucks, more information on the channels through which grain is moving by truck, and data showing to what extent country and terminal elevators are being bypassed, and what effect this is having and probably will be having in the future on grain pricing procedures and on the return the farmer gets for his grain. The Committee also attached great importance to the construction of the Great Lakes-St. Lawrence Seaway and the effect it may have on grain prices and movement in the area around the Great Lakes. These studies will be made cooperatively by the Market Organization and Cost Branch under Bill Dachtler, whose primary interest is in the market organization and price phases, and by our Branch, the Transportation and Facilities Branch, which will study those matters having to do with the transportation and flow of grain.

I have mentioned that in our earlier study it was developed that about 20 percent of the grain moving in the Southwest was by truck. Unofficial information of movements in subsequent years indicates that the truck movement has grown and is at the present time probably closer to 30 percent than to 20 percent. We have had estimates ranging as high as 40 percent, but I think that proportion is a little high.

I want it understood, however, that this trend is not typical of the rest of the United States. There is some movement of grain by truck in practically all areas, but my offhand judgment would be that in the main grain producing areas of Kansas, Nebraska, the Dakotas, Montana, the Pacific Northwest, and the North Central States it probably runs about 10 percent and is probably somewhat greater in the Southwest. However, 10 percent is not by any means an insignificant movement. Moreover this percentage appears to be growing, which accounts for the concern expressed by the Grain Advisory Committee.

To me it has seemed paradoxical that the truck with such high labor costs per unit of transportation, that requires at least 1 driver to move 600 or 800 bushels, compared to the railroads with their ability to move a 100-car train with a single crew, should nevertheless be taking business away from the railroads. Of course, there are several reasons for this, some of which are developed in the report that you have before you. High rail rates, inadequate car supply, poor quality of cars for loading, excessive time in transit, all contribute to the dissatisfaction of shippers with railroad service. The covered hopper car which I have mentioned may afford an opportunity for improvement by the railroads in their service. The grain traffic is highly lucrative to the railroads, many of the western lines depending heavily upon it. If the railroads want to hold this business, they will have to do something about it before it becomes too late.

Our concern, of course, is getting the grain moved in the best and most efficient way. If trucks can do a better job than the railroads at less cost, we want to know it and help the farmers and food handlers prepare for it.

There is one further item I would like to have you consider. I hope that you may be able to make some use of the research findings we have talked about, but in our way we can be a service as well as research organization.

Here is what I mean. Down there in Washington we are quite a long way from many of the grass-roots problems. We do not get the opportunity to get out into the country and talk to people in the field as often as we would like so that we might have a better understanding of what their problems are. However, we have contacts and sources of information that might be useful to you in dealing with the problems of your own State people.

For example, several years ago, John Winfield and other State officials of North Carolina, including the Port Authority, had the problem of deciding whether or not to invest money in port elevators. They asked us to give them a little help, which we did by obtaining data on freight rates and movements through other ports and by making some estimates of the potential traffic such port elevators might be able to attract. Last spring, Howard Brosset, of Louisiana, told me of complaints he had had from Louisiana shippers of strawberries about the railroad service they were getting to eastern cities. We investigated, and through our contacts with the eastern railroads were able to get at the facts and explain to some extent, at least, why the movement was not as fast as they thought it should be. Actually, a considerable part of the difficulty appeared to be chargeable to the shippers themselves because of the practice of billing cars to Markham Yard on the Illinois Central at Chicago, for diversion to eastern destinations, many of the cars being held for some time at Markham before reconsignment orders were received.

I doubt whether we contributed to the solution of any problem, but at least we got some facts for Mr. Brosset which I hope were useful. This job was not the research type, such as the one I mentioned involving the grain movement to North Carolina ports, but it was something that we, with our contacts, were able to do easily. So I suggest and hope that if you run into any problems concerned with transportation, let us know what they are. If we can, we will help you, and we would profit by your aid in letting us know what is going on and some of the problems that are being encountered.

RECOMMENDATIONS OF WORK GROUP

John Winfield, North Carolina, Chairman
W. L. James, Virginia, Secretary
John C. Winter, AMS, USDA, Consultant

The following phases of research were reported and can be used in solving many of our grain marketing problems:

1. More efficient methods and equipment for controling temperature, moisture, and infestation in grain.
2. The advantages of bulk as compared to bag handling of grain.
3. The development of improved work methods and more efficient handling equipment.
4. Improved equipment and methods for loading and unloading grain.
5. Advantages and disadvantages of marketing grain by truck versus rail shipments.

The State service agencies should assume leadership in acquainting facility operators with available research results to reduce costs and increase efficiency. Inevitably, problems will arise in applying research results to already existing operations, and the service people should give technical assistance in adapting those findings which can be of the most benefit. At the same time, they should work with farmers to acquaint them with the advantages of the adoption of new and improved practices. In carrying out this work, State service agencies should cooperate with Extension and other agencies within the State.

The service people should look for research results which may be applicable to the marketing problems of their people. In so doing, they should maintain close and effective relationships with State and Federal researchers. In turn, they should acquaint the research personnel with local problems which need study to give them ideas that may be useful.

IMPROVING CONTAINERS AND METHODS OF PACKAGING FRUITS AND VEGETABLES

Donald R. Stokes, Transportation and Facilities Branch,
Marketing Research Division, Agricultural Marketing
Service, U.S.D.A.

Our packaging research program is pointed toward 2 main objectives: (1) We want to increase the salability of fresh fruits and vegetables, and (2) we want to develop cheaper containers and those which increase the efficiency of marketing produce. As many of you are aware, there are 2 major trends in the packaging of fresh fruits and vegetables: (1) The trend toward prepackaging, and (2) the continued shift toward the use of fiberboard shipping containers. It is likely that both of these trends will continue for some time.

Improved Containers

We have developed a rather systematic approach which we use in developing and evaluating improved shipping containers. We first appraise the containers being generally used by the industry. Then we develop specifications for hypothetically perfect containers, which we release to container manufacturers. They, in turn, design and construct new or modified containers for our experimental use. Cooperating growers or shippers pack and ship the new containers under commercial conditions, and we evaluate them in comparison with the conventional containers used by the industry.

We evaluate these containers from the standpoint of their effect upon (1) the comparative cost and efficiency of marketing the product in the alternative containers, (2) condition of the produce marketed in them and amount of waste and spoilage losses, (3) salability of the produce, (4) trade and consumer acceptance, and (5) net returns to growers and shippers of produce marketed in the containers. We also appraise the efficiency of alternative packaging operations and investigate the need for package standardization and simplification. Now I should like to show you some examples and results of our container research program.

Plum containers. About 4 years ago the California plum industry requested assistance in developing cheaper and improved containers for fresh California plums. The conventional containers used by this industry is the 4-basket crate, which costs in the neighborhood of 55 to 60 cents assembled. A plum advisory committee of growers and shippers was organized which assisted in pointing out the disadvantages of the 4-basket crate and established recommended requirements for improved containers. These specifications for hypothetically perfect containers were brought to the attention of container manufacturers, and more than 30 containers were developed over the 4-year period.

After these new containers were packed with plums and shipped to eastern markets, many of them soon were discarded because of obvious failure of one kind or another. Four containers were finally developed, however, which performed quite satisfactorily.

The first one is a 2-piece folding telescope box with roll ends which fold into place. This new container was liked very well by the trade. It is especially adapted for small plum packing plants because it requires no machinery to set it up and is easily made up by hand; it has great stacking strength; it is easily opened for inspection and has no appearance of slackness of pack because the sides of the inner case are cut down. Its unfavorable characteristics are: It is relatively expensive compared with other experimental containers, and it is unsuitable for automatic makeup or closing. The top layer of plums were placed with their tips up in a tray.

Another experimental container is a half-slotted container with 2-inch top flaps turned out and down. It has a full depth liner and 2-inch flap design type cover fitting over the container flaps. This container is also made with a self-locking 2½-inch roll end cover. Its favorable characteristics are: It is sturdy; it has good appearance; the self-locking cover is easy to open and close for inspection; and it is easy to load in full carlots because spacers are not needed for ventilation since the side flaps on the cover create air channels. Unfavorable characteristics are: The design type cover is difficult to lid and requires restapling if opened for inspection; the self-locking cover is fairly expensive, which must be set up prior to packing; and it does not eliminate appearance of slack pack upon arrival in terminal markets.

The third type container is a regular slotted container with a full liner and tear tape feature for inspection opening. Its most favorable characteristics are: It is sturdy; it has no appearance of slackness of pack because the top and inner liner 1½-inch deep are automatically removed with the top and the fruit extends above the cutdown side; and it is moderately priced and can be mechanically sealed. Its unfavorable characteristics are: When open for inspection, it looks unattractive because the tear tape defaces the container, and it cannot be securely reclosed without taping or stapling.

The fourth type of container is a 2-piece full telescope box with inner and outer case of ½ slotted design. Its favorable characteristics are: Relatively low cost; it is easily opened for inspection; and it can be mechanically set up and closed. Unfavorable characteristics are: It is less sturdy than

other containers; it bulges under certain stacking conditions; and slackness of pack is apparent at terminal markets.

About 30,000 packages of the first 2 of these 4 experimental containers were shipped commercially during the 1955 season. Estimated savings from using these new containers were from 19 to 30 cents a crate, depending upon type and size of container used. We have estimated that nearly 1 million dollars per year could be saved due to lower container cost, less packing labor, and lower freight costs by general use of these new plum containers.

A design bottom pad used in one of these experimental containers speeds up the packing operation.

We expect that molded trays eventually can be used for the bottom pad which will enable a volume fill upside-down pack so that, when the container is open, the top layer of plums would be automatically place-packed.

Winter pear containers. A number of new types of fiberboard boxes were evaluated during the 1953-54 winter pear marketing season. During the 1954-55 marketing season 2 containers were evaluated.

The experimental containers were evaluated by shipping a minimum of 3 full stacks of either one of them in the same car with comparable pears packed in standard wood boxes. A total of 36 of these test shipments, 31 tests of a 2-piece full telescope container and 5 tests of a regular slotted container, were made from the 4 major pear producing districts in Oregon and Washington. Some results of these tests and recommendations for further research to clear up some of the problems encountered are discussed in the following conclusions:

1. Excessive discoloration and bruising were found in the pears packed in the full telescope container.

2. Although only a limited number of test shipments were made, less discoloration and less bruising were found in pears packed and shipped in the regular slotted carton with the veneer Kraft paper liner. However, it is not known whether the difference in the construction of the experimental containers or the difference in their dimensions accounted for the variation in the amount of bruising and discoloration of fruit shipped in them. Dimensions of the boxes probably were the most important factor, but this problem needs additional research.

3. Both of the experimental containers appeared exceptionally sturdy, and no container failure was observed in the inspection at terminal markets. The condition of the full telescope experimental containers and their general ability to stack appeared equally as satisfactory in March 1955, after the containers had been held in cold storage for several months, as they were in November 1954.

4. The possibility of reducing fruit discoloration by changing the dimensions of the fiberboard containers and/or by coating the inside

of them with some material, such as a polyethylene resin or wax, or some similar treatment, appears worthy of investigation. In 3 test shipments observed, pears in polyethylene bags were packed in the experimental containers. Compared with pears in other test shipments, those in the polyethylene bags had much less discoloration, averaging only 3.7 percent, although the same degree of pressure bruising was found in all tests.

Bartlett pear containers. During the summer of 1955, we cooperated with the California Advisory Board for the Promotion of Bartlett Pears in developing and evaluating new containers for Bartlett pears. In this program we evaluated 5 alternative containers, 4 of which were of different style construction of fiberboard and one was a laminated Kraft-paper veneer box. In addition to evaluating the alternative containers, different packs for the pears also were evaluated.

In one container (full telescope box with a paper-veneer liner), an equivalent of around 70 carloads of Bartlett pears were jumble-packed and shipped during the past summer. These pears arrived in fairly satisfactory condition in the western markets, although they did not arrive in satisfactory condition in the eastern markets.

In another type of container evaluated for Bartlett pears, the pears were unwrapped but place-packed. Three types of pack were evaluated: (1) Conventional wrap and place-pack method, (2) naked or unwrapped pears which were place-packed, and (3) naked pears jumble-packed.

More discoloration was found in unwrapped pears than in wrapped pears. Also, we found more discoloration in the place-packed naked pears than in jumble-pack naked pears. Apparently, the pears find their own natural nesting position better in the jumble-pack than they do in place-pack, if they are not wrapped.

An experiment was made on Bartlett pears which were jumble-packed and shipped to New York, where they were inspected and reshipped to Washington, D. C. After they were ripened, we removed them from the box and photographed the pears to show the type and amount of skin discoloration in them. In this particular box, 25 percent of the pears showed some discoloration upon arrival in the New York market, and 51 percent of them showed some discoloration after they were shipped to Washington, D. C., and ripened. We have not developed a better package or better method of packing either winter or Bartlett pears.

Avocado containers. We have just embarked on a program in cooperation with the Florida avocado industry with the objective of determining which type of container is the best for the avocado industry to standardize upon. In their marketing agreement, provision is made for controlling the use of various containers. This industry felt that information was needed to help select the best container; therefore, a number of test shipments will be made as well as observations in terminal markets to evaluate the various advantages and disadvantages of all the containers currently used for shipping avocados.

Apple containers. As you know, there is also a continuing swing toward the use of fiberboard cartons for shipping apples. The packing of highly perishable apples, such as McIntosh and Golden Delicious, in tray-pack and cell-type cartons is rapidly growing because of the favorable trade acceptance and because this type of package delivers the apples to the retailer, and eventually to consumers, with fewer bruises. Polyethylene liners also help to reduce shriveling and maintain higher quality apples and pears.

These experiments illustrate the great amount of work which is necessary to develop an improved container and one which will do a better job of delivering the produce as well as improve its appearance and salability. There is a great need for assistance and service to growers and shippers in guiding them in their efforts toward developing improved ways of packaging fruits and vegetables. Too often we have noticed growers and shippers trying out a new package which is doomed to failure and which can prove a costly experiment. You can help growers and shippers of fresh fruits and vegetables in your respective areas a great deal by advising and assisting them in their selection and use of containers.

Prepackaging Fruits and Vegetables

There is no doubt about the continued increased trend toward more prepackaging of fresh fruits and vegetables. In a paper we presented before the American Management Conference Packaging Exposition in Chicago last spring, we estimated that about 20 percent of all fruits and vegetables are prepackaged prior to reaching retail stores. In this paper we listed most of the fresh fruits and vegetables produced in the annual supply, marketed in fresh form and the percent prepackaged prior to retail level. We observed that approximately 56 billion pounds of fresh fruits and vegetables are marketed annually, and that it is conceivable that about 50 billion pounds of produce could be eventually prepackaged in some form. In addition to the extensive produce prepackaging being done at the producer and terminal level, more and more retail stores are prepackaging fresh fruits and vegetables at store level.

Prepackaging lettuce. Although numerous attempts have been made to prepackage lettuce at the shipper level and at the terminal level, most lettuce today is being prepackaged in the retail stores. Some lettuce was packed in cellophane bags, which were fabricated especially for an experiment we conducted in cooperation with the United Fresh Fruit and Vegetable Association. In this experiment, the United Merchandising Institute arranged for over 100 retail stores throughout the country to experiment with prepackaging of lettuce in these bags. We also made some detailed studies in a few stores where we compared the salability of prepackaged lettuce and nonpackaged lettuce. Store customers preferred the prepackaged lettuce, which outsold the nonpackaged lettuce when they were priced the same. However, when 1 cent more per pound was charged for prepackaged lettuce, only about one-third of the store customers were willing to pay the premium for prepackaged lettuce. We also found that waste and spoilage losses could be reduced by 8 cents per dollar of sale, or from 4.4 percent for the packaged lettuce by weight as compared to 11.2 percent weight loss for nonpackaged lettuce.

There is some controversy, as you are well aware, over the use of extensive printing on film bags for prepackaged produce. We generally advise that we have noticed the "plain printed" bag is increasing in popularity. In other words, many packagers have found that enough print is needed on the bag to make it attractive, but lots of space should be provided to allow sufficient visibility of the product.

Prepackaging tomatoes. A 2-pound package of vine-ripened tomatoes makes quite an attractive package and is especially suitable for packaging home-grown or larger and fairly medium size tomatoes. This type of package is also an upside-down pack. The bottom of the package is inserted after the carton has been filled, which enables it to accommodate varying sized products and still present a full pack appearance.

A few years ago we published a report entitled "Prepackaging Tomatoes," in which we reported results of our observations on the average quality of prepackaged tomatoes available in retail stores. Out of a total of 423 packages we found that only about 22 percent of the tomatoes were perfect and that about 78 percent were defective in one way or another. Nearly 13 percent of the tomatoes in these consumer packages were defective to the extent that we considered them in an unsalable condition. However, during the past 2 or 3 years we believe the average quality of prepackaged tomatoes has increased. Much of this can be attributed to competition among prepackagers to meet the demand for a higher quality prepackaged tomato. Also, much of the credit for improving the quality of the tomatoes can be attributed to the Department's recommendation for shipping them at higher temperatures--not below 55°--in contrast to shipping at lower temperatures, as frequently has been done in the past.

Prepackaging carrots. Substantially all western carrots were shipped to eastern markets in one type of container only a few years ago. As you know, now around 80 percent of fresh carrots are topped and eventually prepackaged in polyethylene film bags. Wirebound boxes, fiberboard cartons, and even polyethylene bags are being used as shipping containers for prepackaged carrots today. The fiberboard boxes and polyethylene bags are reportedly much cheaper than wirebound crates.

We have undertaken research on prepackaging carrots for nearly 10 years. In 1954, we conducted studies in 8 stores in New York, Boston, Grand Rapids, and Detroit metropolitan areas. We found that there is still a considerable consumer demand for bunched carrots, and that bunched carrots accounted for 52 percent of the total sales during the period of the test. However, there is a definite need for constant efforts to improve the standards and quality of prepackaged carrots. The use of colored film for carrots is reportedly banned in some States because of its deceptiveness.

However, the advantages to the retailer of handling prepackaged carrots are very apparent. The costs of handling prepackaged carrots in retail stores amounted to approximately 2 cents per sales dollar as compared to 14 cents per sales dollar for bunched carrots. Waste and spoilage losses for bunched carrots were also much higher, averaging 8 percent for bunched carrots as compared with 0.6 percent for prepackaged carrots.

Prepackaging potatoes. We have done little work on potato prepackaging, although there is no doubt about the trend toward prepackaging of potatoes in polyethylene bags. The State Department of Agriculture in Maine, as well as those in other States, has done considerable work to promote wider adoption of washing and cleaning potatoes. The need for better grading, washing, and cleaning of potatoes to be packaged in polyethylene bags is very obvious.

At a recent packaging conference in Chicago, two of the leading terminal potato packagers in that city advised that, although they were prepackaging most of their potatoes now in paper bags and paper-mesh window bags, they felt the predominant package would soon be polyethylene bags. Some people think that an overall mesh design in the bag enhances the salability of the potatoes, although others believe that it does not provide enough visibility.

Prepackaging soft fruits. Soft fruits, such as peaches, apricots, grapes, Bartlett pears, etc., are not widely prepackaged at this time, although more and more intensive efforts are being made to develop satisfactory packages for them. For example, some fresh western cherries were prepackaged successfully in Mylar bags this past summer. During the past summer, we cooperated with the West Virginia Experiment Station and several peach packers in the Appalachian area in evaluating a new cell-type package for peaches. Since several different size consumer packages were needed, more than one size shipping container also was used, which created a problem in inventory control as well as loading.

Many of you specialists in the State Departments of Agriculture are making valuable contributions in your State in promoting the wider adoption of harvesting and marketing tree-ripened peaches. We feel that some type of consumer package may well be used to market those peaches which are too mature to package in more conventional shipping containers, such as bushel baskets.

One type of package used for shipping Bartlett pears is the same one that was described earlier for vine-ripened tomatoes. A number of carloads of California pears were shipped to eastern markets in this package during the past 2 years. When the pears are not packed tight enough to prevent rolling in transit, considerable discoloration results. We understand that a number of carloads of grapes were shipped in this type of carton this past season, although we did not evaluate their arrival condition.

Summary

In conclusion, I should like to point out that we cannot expect everyone to like the same type of package. Variation in style, design, and printing of consumer packages is helpful to attract attention and to increase sales. I believe that we should assist and encourage the fresh fruit and vegetable industry in packaging high quality and well-graded produce in those containers which are the cheapest or those which do the best job of selling the product.

We appreciate the assistance we received in many of our projects from the marketing specialists in the various State Departments of Agriculture. There is a great deal of work ahead of us to develop, evaluate, and promote better packaging of fresh fruits and vegetables, and we need your cooperation as well as

that of Experiment Stations, package manufacturers, and growers and shippers to carry out this program. Your assistance to growers and shippers in your respective States is urgently needed now while many new packaging innovations are being made.

RECOMMENDATIONS OF WORK GROUP

George H. Chick, Maine, Chairman
Walter S. Mason, New York, Secretary

Extensive additional research and service work is needed to develop new and improved shipping containers for fruits and vegetables. Every consideration should be given to finding ways of reducing the cost of shipping containers, although increased attention should also be given to developing containers which do a better job of protecting the commodity in transit and during handling through the marketing system. Efficiency in the use of such containers and their suitability for stacking and handling in storage, as well as on railroad cars and trucks, should also be given consideration.

Peach containers. More research and service work is needed to find ways of packaging and marketing riper peaches. Tree-ripened peaches are preferred by consumers, and suitable packages and methods of marketing peaches in a more advanced stage of maturity are urgently needed.

Film bags. More service and research work is needed to promote the adoption and use of film packages which provide sufficient visibility to the contents. More consideration should be given to the amount and design of printing on film packages so as not to obstruct the purchaser's opportunity for examination of the contents. The effect of different styles, color, and amount of printing on the salability of packaged produce should be evaluated.

Marketing services. Particular effort should be made to coordinate research activities being carried on by the State agricultural experiment stations with services being performed by the State Departments of Agriculture. This should enable improved and more rapid application of research results.

Standardization. Consideration should be given by various State Departments of Agriculture to the need of setting up uniform standardized containers, particularly cell cartons for apples. At present, the same size apples are being packaged in cell cartons of 96, 100, 112, and 120 count depending upon the dimensions of the cartons. Thus, considerable confusion is caused among apple packers and distributors. It is recommended that officials of the State Departments of Agriculture in the States concerned take appropriate action to standardize cell-pack containers for apples.

REDUCING COSTS OF MARKETING POULTRY AND EGGS

John J. Scanlan, Poultry Branch,
Farmer Cooperative Service, U.S.D.A.

As I understand it, my assignment at this commodity session of the National Marketing Service Workshop is to discuss ways and means of reducing the cost of moving poultry and eggs from the farmer to the consumer. These methods of cost reduction should be based on research findings or a definite knowledge of practices. Frankly, I have been unable to learn of many research findings or really new information which show definitely and specifically how to reduce marketing costs. There are, however, many general approaches which, either directly or indirectly, might result in cost reductions—or at least in greater producer returns. At a service workshop such as this one, with the attendance composed largely of service agencies, I assume that practical and down-to-earth approaches are desired—and expected. In this, I fear that I may disappoint you. I will be discussing, for the most part, possibilities of cost reduction rather than proved methods of such reduction.

If we open this session by discussing the possibilities of reducing the cost of marketing of poultry and eggs, the 2-hour group discussion to follow undoubtedly will bring out the needs or experiences of your service agencies in attaining these possibilities; that is, we might first lay out the field and then fill in by discussing how cost reduction possibilities or problems have been or might be solved.

Importance of Marketing Costs

First we might properly take a look at the importance of the marketing of food products. Many agricultural leaders feel that marketing is the most important phase of agriculture at this time. This opinion appears justified when we realize that out of a total bill of an estimated 46.3 million dollars for retailing farm food products in 1955, 28.0 million dollars is for marketing costs, and only 18.3 million, or 41 percent, is the farmers' share. These figures appeared in the October 1955 issue of The Marketing and Transportation Situation.

Every year since 1947 the marketing bill has increased, although the payment to farmers has remained about steady. In 1955 the estimated marketing bill will be 44 percent higher than in 1947-49, and seems likely to increase even more in 1956. This increase has resulted from rising costs of performing marketing services, an expansion in the volume of products marketed, and an increase in marketing services per unit of product.

That there is need to increase the farmer's share of the consumer's dollar for poultry and eggs is evidenced by the fact that in 1954 the farmer's share of this dollar was the lowest (63 cents) since 1932. For eggs alone, it was the lowest in 1954 and 1950 (67 cents) since 1940. During the 3-month period July to September of this year the farmer's share of the consumer's dollar for fryers was 63 cents, and for eggs, 67 cents. Although the farmer's share of the consumer's dollar for poultry and eggs was larger (65 cents) than for the market

basket (40 cents), this share is unusually low for the poultry raiser and is indicative of his plight.

Marketing margins are relatively inflexible. As a result, the lowering of retail prices usually and eventually results in this reduction being passed on to the producer. Our problem, then, is to make reductions possible in the marketing margin through reduction in the marketing costs. How and where can this be done? What are the possibilities? What recent research findings can be applied? What research is needed to help us to reduce marketing costs?

We, in State and Federal marketing work, have a big and an immediate job to do. This job is one of increasing both marketing efficiencies and marketing effectiveness. For us in agriculture this job is important because, as stated above, a large part of the marketing costs, as well as the impact of ineffective marketing, must be borne by the producer. Reductions in marketing costs will rebound to the benefit of the producer either through a larger portion of the consumer's dollar or normally in some increase in consumption by virtue of lower prices to the consumer.

Usually we speak rather loosely of reducing marketing costs or of the producer-consumer price spread. At the same time, we may fully realize that costs and margins seem likely to continue to increase due to the greater services demanded by the consumers and others, the increasing rate of pay for personal services, and many other costs. What we really mean is to do a better job of marketing by (1) making it more efficient or productive, (2) making it better, and (3) making it easier. So, to speak of reducing costs is to speak relatively rather than absolutely.

Also, the term "producer-consumer price spread" is hazy, abstract, and difficult to grasp, since it is such a broad term, with such a wide range about an average. The farmer's share is very low for such farm products as tobacco and grains for food (about 15 percent) and considerably higher for products which require less processing, such as meats (53 percent), dairy products (45 percent), and poultry products (65 percent). These are preliminary figures for the period July to September 1955.

The producer-consumer price spread for the egg producer in Bucks County, Pa., who sells his eggs directly to the Philadelphia housewife, is quite different from that for producers in more distant areas. The South Dakota farmer sending eggs to the Philadelphia market will have his eggs carefully sorted locally, with the better quality passing through perhaps half a dozen handlers. His eggs will then be transported the 1,500 miles to Philadelphia, and can be expected to sustain considerable quality and physical loss before reaching the housewife. This example is cited merely to show that the opportunities for cost reduction vary widely because of many factors. With this understanding, we may now proceed to use more freely the term "reducing costs."

Potential Areas in which Marketing Costs May be Reduced

Before we undertake the job of trying to reduce marketing costs, first it is necessary to have information to make possible the measurement of costs. Adequate and accurate cost data must be assembled or collected. The second step is to analyze and compare these costs to determine their importance and whether they might be reduced. The third step is the determination of ways and means of reducing costs.

The comparatively small amount of research work that has been done specifically on marketing costs in the poultry field shows wide variations in costs among firms or organizations. These variations indicate the possibility of reducing at least some of the costs. Most marketing costs appear susceptible to reduction--at least on a per-unit basis, if not in total.

Some are more susceptible than others because of their very nature. It may be impossible to reduce labor cost on a per-hour basis because of legislation, labor unions, etc., but it may be greatly reduced on a per-unit basis by greater man-hour output. Also, the amount of possible cost reduction may be small at some marketing levels, in some items, elements, functions, steps, or jobs, and may be large in others. For instance, probably little absolute reduction can be made in the cost of sticking poultry in the bleeding process, not because the process cannot be speeded up or otherwise improved by new methods, but because the entire cost of this operation is already very small. On the other hand, the pinning operation formerly required from 40 to 60 percent of the man-hours of labor in a dressing plant and, therefore, afforded the greatest potential for cost reduction of labor. Again, however, the cost of materials in egg-handling operations--usually a major cost--may not be easily susceptible to reduction, because beyond an order of a carload or some other specific amount of these materials, the per-unit cost may not decrease.

Where, what, and when are the most important areas of potential cost reduction in the marketing of poultry and eggs? We might approach this field at 3 major levels in the marketing process: (1) Farm marketing, (2) assembling and wholesaling, and (3) retailing.

Farm marketing. Usually we say that marketing begins at or when a product leaves the farmer's gate. This is a convenient place to consider as the beginning of the marketing channel, but for our purpose here it would seem well to include some services performed on the farm (1) which, because of their nature, might be rightfully included in marketing, or (2) which directly affect later handling and handling costs in the marketing channel.

What can be done at the farm level of marketing to reduce costs of marketing eggs and poultry? Certainly the farmer might reduce the producer-consumer price spread on these items by performing on the farm as many marketing or premarketing services as his time and situation permit. However, the performance of these services may not increase his returns as much as an equal amount of time spent in producing larger volumes to market. The farmer may market his eggs and poultry as directly as possible to the ultimate consumer, provided his location is convenient to consumer outlets. The development of vending machines

for eggs is one way in which a State college (Cornell) is trying to help poultrymen and others to sell eggs without the need of personally waiting on customers. With such machines now becoming available at a moderate price, and with sufficient volume, this device may help some producers reduce the time and, therefore, their cost of direct marketing.

It has been said that a product well-produced is half sold. Certainly products which are of high quality cost less to market because they may require less rehandling and have less waste due to spoilage or off-quality. It has been found that when a greater proportion of quality eggs are sent to market, producers receive better returns, handlers may reduce their costs because of the smaller number of undergrades handled, and consumers may benefit by a lower price. However, it is not my intention to go into the possibilities of reducing marketing costs by maintaining quality. The problem of quality maintenance has been widely studied and was ably discussed here yesterday. It might be repeated, however, that the production and maintenance of good or high quality is an important foundation stone in lowering marketing costs. By quality maintenance and proper packing of eggs on the farm, frequent delivery, and the preformance of other functions, the producer usually can reduce his marketing costs--or increase his returns by more than the added cost of these operations.

Retailing. Let us next skip to the possibilities of reducing the cost of retailing poultry and eggs, and then we will consider what can be done at the wholesale level. The retailing cost is substantial. A limited study made by Conlogue of the Agricultural Marketing Service showed that the retailers' margins on eggs averaged 10.5 cents per dozen in November 1954. This margin was about the same percentage of the retail price as the average margin on all items sold. In his study Conlogue made no attempt to determine the cost of retailing eggs in food stores because of the difficulty of separating egg-handling costs from those of selling hundreds of other products. Since eggs are a breakable and perishable product requiring refrigeration in the stores, it is doubtful that the retail margin on them can be reduced much, if any, below the average margin on all items. However, since the retailing cost is such an important phase of marketing eggs and poultry, it is one deserving much study.

Supposedly, the keen competition between retailers and the rapid and competitive development of chain food stores will keep retail margins within reasonable limits. The increase in the volume of eggs obtained directly from the farm by some chainstores may be helpful in reducing the producer-consumer price spread. On the other hand, some agricultural leaders view this trend with some concern because of its wider implications. Possibly other assemblers and handlers of eggs, including producer organizations, are not doing their job well enough in some areas so that the chains are taking over. In any instance, this development is a real challenge to other egg handlers.

In my opinion, a low-cost method of retailing eggs could be developed in cities where apartment buildings abound. Some person in the building, perhaps a housewife, could distribute, on order, "fresh" cartoned eggs to the occupants at a small mark-up. This distribution might be done on Fridays or Saturdays only. It should move eggs rapidly and thus maintain their freshness, give the handler

a small income, appeal to some people because of the personal contacts, and be withal a low-cost method of distributing eggs.

Assembling and wholesaling. Although there are opportunities and possibilities of reducing marketing costs at both the producer and retailer levels, it is usually at the in-between level that we look for economies. However, the functions and services performed at this level may be performed by either the producer or the retailer. At any rate, an area that may be productive of economies is the one from the time the eggs or poultry leave the producer until they reach the retailer.

Where at this level are there the greatest opportunities for cost reduction? Conlogue's study in 1954 showed the year-round margin of nearby country assemblers to be 3.5 cents a dozen. The wholesalers, who obtained these eggs and candled and packed them for retail stores, hotels, restaurants, or the Army, operated on an average margin of about 8 cents. Of the wholesaler margin, labor constituted 2.5 cents; materials 2.8 cents; egg replacements 1.2 cents; and overhead, profit, and miscellaneous 1.5 cents. Thus the total farm-to-retailer margin was 11.5 cents. Of this total, about 3.5 cents was for materials and supplies; about 3.0 cents for labor; and 2.3 cents for overhead, general expenses, and profits.

A study of the costs of handling eggs by 25 cooperatives in the North Central and Northeastern States showed that direct costs constituted an average of 77 percent of total costs; and indirect costs, 23 percent. Total labor cost, both direct and indirect, accounted for nearly 43 percent of total costs. Packing material was the next most important item, accounting for about one-third of the total cost. Truck costs constituted about 13 percent. The remaining 11 percent consisted of miscellaneous small, direct items and of the indirect costs exclusive of indirect labor.

Since labor costs per unit are a large part of the handling costs, it is in this item that the possibilities of cost reduction appear greatest. As shown later, our own cost studies disclosed wide variations among plants in labor costs per unit and in output per man-hour. The results of these studies indicate that labor can be used more efficiently in some, if not all, plants. Economies can be achieved by better plant layout, more and better equipment, improved techniques, more personnel training, and employee incentive programs.

In the cost work which we have done, the handling operation is broken down into stages or phases to facilitate comparison and to isolate each for study. For instance, a wide range was shown in the cost of assembling eggs. The clear and obvious answer to low assembly cost is the procurement of a large volume over a short route. However, duplication of pick-up routes results in increased costs and lower quality due to less frequent pick-up. The further answer here seems to be assembly by fewer firms--either by buyers or by truckers who haul for a number of handlers. The regional study of egg supply and marketing in the North Central region shows, among other things, the intensity of egg production in different areas. This information may be of assistance in the planning of market organization, including procurement.

Work Done to Bring About Reductions in Marketing Costs

Eggs. In the January 1955 issue of The Marketing and Transportation Situation, Conlogue and Pritchard, Agricultural Marketing Service, suggest that efforts to reduce the producer-consumer spread on eggs be directed at the following general steps:

1. More careful handling of eggs on the farm.
2. Reduction in the number of undergrade eggs shipped.
3. The candling, sizing, and cartoning of eggs at country plants.

All of these efforts have been found feasible in substantially reducing the cost of candling and cartoning eggs. Additional study of the feasibility of country-point candling and cartoning will soon be underway in the U. S. Department of Agriculture.

As a result of findings in our cost work with egg cooperatives, we are in full agreement with these 3 suggestions but suggest 4 additional possibilities. These are:

1. The concentration of larger volumes to facilitate more efficient plant operation. Small volume plants cannot afford some of the most modern equipment. To accomplish this end, in our work with cooperatives we are recommending merging, consolidating, or coordinating of effort, through federations or otherwise, to obtain sufficient volume if it is not otherwise available.

2. The use of better designed plants and of up-to-date equipment to handle eggs, such as roller, belt, and power conveyors, dollies, skids, pallets, power trucks, mechanical egg sizers, photoelectric equipment for detection of rots, blood and meat spots, and other automatic labor-saving devices.

3. Less costly sampling techniques to determine egg quality, especially at the first-receiver level. Several studies on this subject are currently underway, including one by the Farmer Cooperative Service.

4. New techniques which will facilitate returns to producers on the basis of egg quality and size, plant mechanization, and bookkeeping and accounting procedures, and which will smooth the seasonal flow of eggs to the plant. In the Farmer Cooperative Service we have developed techniques which we hope will help accomplish these objectives. A report will be issued on part of this work in the near future.

Poultry. The costs of handling poultry, especially broilers and turkeys, in some marketing channels have been substantially reduced during recent years, particularly in the processing operations. In some poultry plants, the present cost of the New York dressing of broilers is as low as one-half of the live-dressed margin allowed under the Office of Price Administration during the war years. This shows much progress.

Some of the developments which have resulted in lower costs in the processing of poultry are as follows:

As a result of progressive breeding programs, the higher quality of poultry, again especially broilers and turkeys, has resulted in reduced costs in the dressing plant because of more top quality birds, more desirable feather color, greater uniformity in size, and desirable body conformation.

For poultry which is to be quick-frozen or moved rapidly to the consumer, the use of higher water temperatures for defeathering alone has reduced substantially the amount of pinning necessary, and has resulted in a higher percentage of top-grade birds. Manufacturers of dressing plant equipment have made great strides in the development of better scalders, pickers, sizers, washers, and eviscerating, sanitation, and other plant equipment. Product flow, layout, and sanitation in the plant have been greatly improved.

The use of larger plants in many cases has resulted in lower costs. At present the U. S. Department of Agriculture, in cooperation with the Northeastern Poultry Marketing Research Committee, is making a study of the costs of dressing poultry with size of plant as an important consideration. Although large plants are usually considered more efficient than smaller plants, some research work done earlier showed that the cost per unit dressed in some small farm and commercial plants to be less than in large plants. This lower cost may be due to the use of family or other low-cost labor, fuller utilization of employees, small investment in land and facilities, and less administrative and other indirect and overhead costs.

Work now underway in the Agricultural Marketing Service shows that some income can be derived through the sale, processing, or utilization of inedible byproducts, thus reducing overall dressing plant costs by the amount of this net income.

Within the past few years a brine immersion method of cooling and freezing ready-to-cook poultry has been developed. This method has much promise from the standpoint of (1) minimizing contamination of poultry during handling operations, (2) reducing overall handling and labor costs, (3) more rapid cooling than is realized by either slush-ice or air chilling, (4) eliminating a leaching of flavor from poultry during slush-ice cooling, (5) less shrinkage than in air cooling, (6) more uniform cooling and higher quality of end product than from tank cooling, and (7) more effective utilization of refrigeration equipment. Dr. Lyle L. Davis, Biological Sciences Branch of the U. S. Department of Agriculture, a codeveloper of this method, did not discuss this method at the session yesterday on maintaining quality of poultry and eggs.

A phase of poultry marketing which needs study and much improvement is that of price differentials between heavy and light fowl. In some areas of the West North Central States the price of live fowl has dropped as low as 6 cents a pound for light fowl and 7 and 8 cents a pound for heavy fowl during the fall months. When this fowl reaches the eastern markets, it is usually sold as stewers. Here it commonly sells at a higher price per pound at retail on a

ready-to-cook basis than do broilers and fryers, whose live price at the farm is often 3 or 4 times as high. Some research work is now underway in the Northeastern region, but no findings are available as yet. The solution appears to be chiefly one of market organization. Producer groups in some areas may find it necessary to take a hand in this problem if it is not otherwise corrected.

Little needs to be said about the economies of country plant evisceration. The rapid shift from marketing live and New York dressed poultry to eviscerated poultry may be answer enough to cost and other advantages. The problem is now boiling down to what place in the marketing channel should this operation take place--at the dressing plant or in the meat department of the retail handler.

There appears to be little objection to the retail margin on turkeys. The use of turkeys as a loss-leader by some chainstores and others at Thanksgiving and Christmas is largely responsible for the low retail margin on a large portion of the turkeys.

There is need to learn how frozen cut-up or whole eviscerated poultry can be sold at retail at prices more in line with those of the fresh products.

Summary

Research work directed at costs, margins, and efficiencies in egg and poultry marketing is still in the initial stages. The studies completed leave much to be desired chiefly because this is a new field of research, funds for it have been difficult to obtain, and personnel trained or experienced in marketing research are hard to find. Some figures have been obtained to measure costs; these costs have been analyzed; and some use has been made of these findings to reduce costs. However, it might well be admitted that research work to reduce marketing costs has been largely exploratory and on a piecemeal basis. A mere start has been made in this type of work.

According to AMS Report No. 56 for 1953-54 on Marketing Service Programs carried on by State Departments of Agriculture under the Agricultural Marketing Act of 1946, 31 States and Alaska, Hawaii, and Puerto Rico participated in these programs. Of these 31 States, 22 reported program activities on egg and poultry marketing. These activities dealt with various types of services, chief among which were market information and news; packing, grading, and handling assistance and demonstrations; labeling programs; hatchery output; and market organizations.

Thus, with nearly half of the State Departments of Agriculture participating in programs under the Agricultural Marketing Act of 1946 as it relates to egg and poultry marketing, it appears that great strides have already been made by them to attain the aims of the matched-fund marketing service work. These aims have been listed briefly as follows: (1) To provide more timely and better market information, (2) to help maintain the quality of products as they move through the marketing channels, (3) to help reduce marketing costs by encouraging the use of the best marketing practices as they are brought to light by research under the 1946 Act and by other means,

and (4) to encourage increased consumption of farm products. Beyond the program under the Act, in 46 States egg laws have been enacted. Most of the recent egg laws and revisions of the older laws tend toward uniformity and are concerned chiefly with grading, grade labeling, accurate representation of the product at the retail level, and more enforcement directed toward retail outlets. The enactment of sound egg laws and their enforcement can do much to lower marketing costs, encourage quality programs, and obtain greater consumer acceptance.

In concluding, I want to say that our work in the Farmer Cooperative Service is concerned not only with marketing research but equally with market service and educational work. In fact, a large part of our work is of a service nature but limited chiefly to farmer cooperatives. So we appreciate the need for and value of research work in its direct service application to marketing problems and marketing organizations. Much of our research work is done for direct application to specific marketing problems; some of our research work is directed at more general problems and in cooperation with other agencies, both State and Federal.

At this time I also wish to say to you folks in the State Departments of Agriculture that we in the Farmer Cooperative Service are seeking to work more closely with you in our work with farmers in their cooperative marketing, purchasing, and service efforts. Our staff is relatively small and is made up largely of commodity and functional specialists. We therefore must work through other agencies to extend our efforts to cover our field.

In the past, I fear that in the field we have tended to work too exclusively with the departments of agricultural economics, the Extension Service, and commodity departments of the Land-Grant Colleges and State Experiment Stations and not enough with the State Departments of Agriculture. In some States the Departments of Agriculture have been more interested and active in marketing and in cooperative marketing than have the other State agencies. It is our hope and plan to work more closely in the future with the people in marketing service work in the States than heretofore.

A year ago we had a conference with officials of the State colleges to strengthen working relations. Perhaps in the near future, we can hold a similar conference with marketing officials of the State Departments of Agriculture.

RECOMMENDATIONS OF WORK GROUP

Tom Fox, Oklahoma, Chairman
R. J. Park, Tennessee, Secretary

Producers and marketing agencies have a real responsibility in reducing the marketing costs of poultry and eggs. There was general agreement in the work group that cuts in marketing costs could be brought about at the farm and continue throughout the entire marketing channel by the application of methods that our research people have proved would reduce marketing costs. Some of these possibilities are: (1) Establishing assembly points in egg and poultry producing

areas where producers may assemble these products in quantities to cut transportation costs to markets; (2) sorting eggs as to size and cleanliness, with emphasis on the proper cleaning; and (3) careful handling of poultry to reduce bruises or broken bones.

In our efforts to cut marketing costs, special attention should be given to the general layout and upkeep of processing plants and to the performance of their equipment. This information should be made available to the industry by the marketing service people. Another way by which distribution costs have been reduced in several States is through the marketing of eggs with milk deliveries. This method could well be adopted in other areas. The group feels that marketing service agencies have a real challenge to bring about reductions of costs in these fields and others.

COUNTRY LIVESTOCK AUCTIONS

Cortes G. Randell,
Livestock and Wool Branch,
Farmer Cooperative Service, U.S.D.A.

Growth and Development

In the national survey of livestock auctions which we conducted in 1939 we found over 1,500 auctions in operation in the United States. Many of these were started during the depression when farmers needed a market or place of exchange for livestock, farm implements, household goods--in fact, about everything which might yield ready cash.

With further improvement in roads and transportation facilities, coupled with promotion, auctions continued to grow until they pretty well blanketed the country. Today there are approximately 2,400 in operation in the country. According to Washington Bulletin 537, 23 percent of northwestern livestock is marketed through auctions. According to Bulletin 26 of the Southern Cooperative Series, in the South--except in mountain areas--60 percent of all slaughtered livestock is sold through auctions. About 50 percent of livestock in the Northeast and some 15 to 20 percent of livestock in the Midwest move through auctions.

Due to their importance in livestock marketing, auctions need to be studied and evaluated and recommendations made for such improvements in marketing structure, facilities, and services as are needed.

Organization Structure and Financing

Practically every type of organization set-up is found in country auctions. Many auctions are owned by individuals, or partnerships. Some are stock companies formed by farmers or stockmen. Some facilities are set up on a capital stock basis, and the stock is owned by businessmen as well as farmers. The Central Michigan Livestock Market at St. Louis, Mich., and the large auction at

Battle Creek, Mich., were set up on such a basis. Each of these markets has its own board of directors. These agencies lease their facilities to the Michigan Livestock Exchange to operate.

This is not a good arrangement. When the manager of the leasing agency wants to make needed improvements, he has to obtain approval from 2 boards of directors. Then, too, the operating company has to pay a fixed rental and, of course, can make no depreciation charge to lessen taxes.

The corporate set-up is now being corrected by the establishment of the Michigan Producers Livestock Cooperative. This cooperative will be a capital stock subsidiary corporation, with Class A common stock having a par value of $10 per share and Class B voting stock having a par value of $1. Farmers in a local area desiring a marketing service will purchase sufficient stock to pay for the facility. The facility will be owned and operated by the Michigan Livestock Exchange.

Another type of corporate structure is found in the producers' set-up in Indiana, where the central organization, Producers Marketing Association, Inc., owns the local facilities. When a group of producers want a local facility, they are given assistance in raising the money therefor. According to the usual plan farmers buy stock in the central organization. The money received from the sale is used in building the local facility. An advisory committee of farmers around each of the facilities functions much as a local board of directors.

In the Empire Livestock Marketing Cooperative, Inc., in New York (a chain of 7 auctions), all accounting, financing, and credit checks and controls lie with the central organization.

The Producers Livestock Cooperative Association, at Columbus, Ohio, which operates a chain of 35 auctions, terminal and local markets, has been partly financed through retains withheld by the organization. Debenture bonds with 10-year maturity, bearing 3 percent interest, have been sold since 1950 to finance new and rebuild stockyards and facilities. These bonds are usually sold to build facilities in a definite location, but facilities are the property of the central organization regardless of where constructed. At present the association issues debenture bonds drawing 4 percent interest to cover the patrons' equity. These are subject to call by the board of directors.

Location

Often too little attention is given to locating auctions. Many points have been selected without an adequate survey to determine the best location.

A notable exception to this practice is the policy of the Empire Livestock Marketing Cooperative, Inc., in New York State in establishing its chain of auctions. Fifty thousand dollars was raised at the beginning, and the manager was instructed to take 6 months, if necessary, to carefully survey New York State to determine the best locations. This practice was followed, and as a result a

minimum of lag in getting underway and on a profitable operating basis was experienced.

The local surveys were based on the following lines of research (1) estimating expected volume, (2) choosing the market center, and (3) choosing the site in the market center.

Determining the right size facility is not easy. It is often necessary to change original plans. Then, when built, the facility may be found to be undersize unless proper provision has been made for expansion. This results in a hodgepodge and inefficient facilities. I recently worked with an auction that was built to handle 1,200 to 1,500 head of stock per week; now the volume is 3,000 head. You can imagine the situation.

A multitude of factors are involved in the third item--choosing the site in the market center. One auction gave careful consideration to locating on a good highway and railroad and near a growing town. However, it forgot about drainage and sewers, and the day the market opened there was a foot of water in the office and part of the pens were flooded.

Management

The caliber of management in auctions usually varies with the size of the operation and the services rendered.

The manager of an auction, whether he is a paid employee or the owner, must be competent and able to perform a variety of service. He should be qualified to cut out in a feedlot or pasture those cattle carrying the proper finish for market. On market days he may sort, grade, and shape up stock prior to the sale or train men to do this job. The manager needs to be thoroughly informed on prices of each class and grade of stock so that he can start the bids or check on an auctioneer or ringman who starts the bids. Also he should be able to protect his market when necessary. In addition to these duties, he should be qualified to work with county agents and Extension and University workers on livestock improvement projects, feedlot tours, outlook meetings, etc. in his market area. He needs to be a good publicity man, and must be able to prepare articles of interest and human interest stories for local newspapers and handle radio and television broadcasts. All these requirements call for a double-size man. But no individual with lesser qualifications should try to run an auction, especially a large auction.

In addition to foresight in planning for efficient operations, a successful auction depends on a high degree of business integrity on the part of management. Consignors must have confidence in management. Buyers must be treated fairly.

Services rendered such as grading, sorting, and care of stock appeal to patrons but must be counted in as costs. It takes an alert manager to figure out ways and means to build volume and reduce operating expense per unit. He must look for short cuts and devise labor-saving devices to cut costs wherever possible.

Design and Special Features of Facilities

Auction facilities range from small converted barns, found throughout the Northeast and in many Southern States, to large markets covering several acres, found in other sections of the country. There are a few large facilities operating in the Northeast, but they are the exception rather than the rule.

Auction barns should have a monitor-type construction or some similar means to insure good natural light. Some auctions are now using plastic materials to give plenty of light, especially over the ring. These materials can be purchased in corrugated form like metal. Various colors are available, and they cost only slightly more than aluminum or sheet metal. They are unbreakable and bring in natural light from the outside.

With high labor costs it is essential to have alleys and pens constructed to utilize power machinery in cleaning alleys and pens. Six-foot alleys which are found in many auctions leave no alternative but to clean the yards with shovels and wheelbarrows.

Paving is essential for all classes of stock. Some operators argue that an exception should be made with sheep.

A double set of docks, one for receiving stock and the other for loading purchases, prevents delays in cross movement of livestock through the yard. Enough dock space should be provided so that trucks do not have to wait 1 to 2 hours to unload as is sometimes the case. Since so many trucks carry 2 or 3 species of stock, the receiving pens from the dock can be divided so that the trucks can be unloaded faster and get away from the docks. A raised platform between the two sections of the receiving pen facilitates branding or marking of stock.

Catwalks over pens to facilitate observing livestock without interfering with sorting and handling of livestock in the alleys are most important.

Insulating the auction ring from the pens is an excellent feature.

Removable pen partitions which enable a facility to be used for livestock shows is a good feature, along with a buyers' room with phone booths and tables or desks for buyers to make notes. The scales should be located adjacent to the ring. Consignors and buyers should be able to view the weighing operation and see that the scales are in balance. The weight and lot number can be recorded on a revolving blackboard by the weighmaster.

The numbers and the relative heights of loading and unloading docks should be based on a survey to determine percentage of trucks of each type loading and unloading at present or comparable marketing facilities. Low trailers should unload inside of a large pen instead of at a dock to save time.

Gates should swing with the flow of livestock and be hung to "funnel" livestock into and out of pens with a minimum of animal movement. Alleys should have catch gates to facilitate handling lots of stock. The recommended size

of pens is 12' x 24' for cattle and 12' x 12' for hogs. Some pens should have additional gates within the pens in order to make smaller units when necessary. Adequate "cutting" chutes should be provided for all kinds of livestock expected at the market. "Buyer's" pens for regular buyers are necessary. The first stock going through the sale, though, can be yarded in some of these pens. Pumping water and feed facilities should be included in some pens. Where 2 scales are used, one should be of small capacity to speed the weighing of single animals.

The "hot corner" leading to the scale should have a double alley arrangement--one unit for pens or groups of stock, the other for singles. Hydraulic gates operated by the weighmaster or a special operator greatly facilitate movement of livestock through the ring.

In most auctions livestock is being received, yarded, sold, and loaded out at the same time. To meet these conditions careful planning for smooth flow is needed. Arrangement of yards must avoid crossflow of animals, with accompanying delays in movement and extra labor for handling.

Adequate facilities make a world of difference in time and temper saving for yard and office operators.

Operating Methods

In a survey of livestock auctions conducted in the Northeastern States it was found that auction owners and operators purchased on the average approximately 50 percent of the volume passing through their sales. The purchased business was in direct competition with the consignors' stock. Some of the auction owners auctioneered the stock. On the other hand, many of the leading auctions issue their own rules and regulations. Some forbid auctioneers to consign their own stock through the auction or to purchase livestock at the auction. Auction owners and operators who are interested in conducting an honest auction will be alert for favoritism shown buyers, and auction will be conducted so that they themselves are not shown favors.

Size of lots sold is important. Obviously sale of singles is a slow and costly business. In larger auctions, it is certainly an advantage to sell hogs in a separate ring. Wherever possible lambs and calves should be graded and sold in pen lots rather than run through the ring singly. In a large auction for a sale lasting 12 hours, for example, the time for selling graded lots of lambs can be a 15- or 20-minute break in the sale. This break will give the crew a rest. One auction which sold 600 to 700 lambs per sale in singles and ran from 12 o'clock noon to 3 o'clock the following morning began grading lambs and selling in the graded lots. This method of selling reduced average time of the auction sale by 3 hours.

Some agencies go overboard in their efforts to serve buyers. Some auctions permit buyers to charge long-distance telephone calls to the auction. Others pay for buyers' meals. Practices of this character border on abuses. Practically all buyers either are on salary or are owners of plants and should not expect favors of this nature.

Most States provide some type of inspection at auctions to prevent diseased stock from going through the ring. Where such inspection is not available, the auction owners owe it to themselves and their community to provide inspection and prevent diseased animals from entering the ring. All premises should be periodically cleaned and disinfected.

A very important problem in operations has to do with the granting and extension of credit. Many of the buyers purchasing livestock at auction markets do not have satisfactory financial ratings to justify the extension of credit, and yet auction markets time and again are called upon to extend credit to buyers who are poor credit risks. These are chances which every livestock auction is called upon to take and they should use every means possible to protect themselves against credit losses. A whole year's profit can easily be lost in one bad account. Many livestock auctions take out surety bonds to protect producers against failure of the auction to pay them for livestock they delivered for sale through the auction. Unfortunately these types of bonds give no protection whatsoever to the auction itself, and auction markets have to stand any losses they incur through poor judgment in the extension of credit. Market operators should constantly watch their credits and avoid undue risks.

If accounts become doubtful, auction operators should secure a chattel mortgage on the plant's machinery and equipment, secure an assignment of receivables or an indemnity bond, or take some other legal means to protect the auction.

Services

A wide variety of services are provided by auctions. They vary from the simple operation of selling a consignor's livestock to rather complete accommodation such as field service, where livestock is appraised on the farm, in pastures, or feedlots for weights and value and even sorted, graded, and cut out for market shipment. Other services include order buying of stockers and feeders and fat stock, order selling of feeder and fat stock, and also order bidding, and market news service, employing television, radio programs, market cards, ads in newspapers or magazines, and feature articles in newspapers and magazines.

Selling

Of all the services performed by an auction agency, selling is the main job.

Practically every auction operator knows the reluctance of producers to be among the first 10 consignors in the sale. This problem arises since most auctions give producers lot numbers and sell livestock in the order of arrival at the sale. Producers do not want the first 10 lot numbers because they feel the buyers are not warmed up. Some producers have been known to bring in their livestock in a truck or trailer and let it sit 2 or 3 hours before unloading so that they would not be among the first few numbers. If shippers are convinced that the auction is protecting the sale at least in the beginning, this problem is not acute.

The selling service of the auction should not be confined to the regular butcher and stocker and feeder animals at the auction. Many auctions have

supplemented their earnings and services to farmers by holding sales of purebred stock, special sales of feeder cattle, and sheep and dairy cattle.

A good auctioneer is the key to a successful sale. He must be a good judge of livestock, keep the sale moving, and give livestock a good workout without dragging the sale. He should make his words intelligible. Many auctioneers fail to accent the change of a front figure on a bid and the quarter or half dollar mark, which is important for farmers or inexperienced buy bidders.

Purchase and Distribution of Stockers and Feeders

An auction operating in a large feeding or pasture area can render a distinct service to stockmen by purchasing and distributing stocker and feeder cattle and sheep. This stock can be obtained directly from the range country and sold through the auction at special sales. For this service handling charges should be kept at a minimum, as the auction will probably have the opportunity to sell the stock when ready for market. An intelligent handling of this program will not hurt the sale of local feeder stock.

Order Selling

Another service which some auctions are rendering is a sales service for fat and butcher cattle sold direct from feedlots and pasture to packers. The employee of the auction is the agent of the producer. He contacts packers and slaughterers who kill the animals the producer has ready for market and effects a sale. The association's representative takes a buyer to the member or feeder's feedlot or pasture, or he may purchase the stock, without the buyer being present, at a predetermined bid or agreed price.

Order selling is no substitute for the competitive auction market. It must be recognized, however, that some buyers prefer country trading, and some producers prefer to sell their livestock on their own farms or ranches. This service would be designed primarily, therefore, for the producer and the buyer who are not market-minded. This service would be available in those cases where the producer wanted expert sales help because he was not certain of the value of his livestock or his ability to bargain with an experienced packer buyer who knows weights, grades, yields, and values of the cattle.

Order Bidding

There is another service which should be mentioned. If the time should arise when the volume of cattle and calves received at the market would outstrip the buying competition, then the auction would be justified in establishing an order bid service. This service would be a systematic means of protecting the sale. Under this arrangement a trained buyer would solicit firm bids before the sale for both stocker and feeder and butcher stock. Bids would be solicited from producers and slaughterers, feedlot and pasture operators, and ranchmen. These orders would be filled through the sale by competitive bidding with other buyers.

Factors Affecting Costs and Efficiency

In attacking the problem of reducing costs and increasing efficiency, the assault must be made from the front and both flanks.

An auction operator should never be satisfied with his facilities or operating methods. There is always room for improvement. For example, one auction operator has a ringman open, by hand, the gate that lets the stock out of the ring. Another auction speeds up this operation by boring a hole through the gate and attaching a rope to the latch on the outside which runs through a pulley above the gate and over to the auctionner. When he completes the sale, he pulls the rope which releases the latch. The gate, which has springs on the outside, flies open. Thus several seconds usually lost in getting the stock away from the gate to open it are saved.

Another auction further speeds up the operation by putting in hydraulic gates leading in and out of the ring operated by one man. Still another auction, not to be outdone, employs a very experienced weighmaster who can handle scales like Houdini, the magician who used both his hands and his feet in making escapes. The weighmaster weighs with his hands and manipulates the hydraulic gates with his feet. Naturally, the labor saving in such an operation is substantial.

Much time can be saved in the ring if the auctioneer knows values and can start bids at approximately the value of the animals and does not have to back up on this starting bid. Much time is wasted in the workout of animals. One auctioneer averages 16 seconds worktime on butcher cows; another averages about 30 seconds for the same class of stock. At one auction 2½ minutes is used for selling a dairy cow; another does as good a job in one minute average. The auction owner is paying the bill for this extra time.

Hours and hours can be saved in sales by group selling of stock. I mentioned previously the instance where 3 hours were cut from a sale by selling lambs and sheep in groups. Similar savings in time can be made by selling penlots of calves and cattle. Three auctions in Ohio are sorting and grading calves and selling them in weight ranges of 10 to 15 pounds. Recently I saw 260 calves handled and sold in 20 minutes. There were 26 drafts, which included 10 singles and 16 penlots.

Aside from the saving in time producers in most cases actually receive more money for their stock by selling them in penlots. I recently made some comparisons of prices received for penlot cattle and singles of the same grade and weight at a livestock auction in Florida. In the case of common stocker steers there was a definite price advantage ranging all the way from 40 cents to 75 cents a hundred or better in favor of the penlot cattle over singles. There was also a price advantage in selling utility grade slaughter steers in groups, but this amount was much smaller, ranging from 5 cents to 45 cents a hundred. Comparison of prices received for penlots of slaughter cows of the cutter grade and singles showed no advantage in favor of group selling.

The office should not be forgotten when the problem of reducing costs is attacked. Advantage should be taken of labor-saving equipment. Some of the

markets have acquired machines for preparing account sales and account purchases and for billing buyers. The machines calculate gross and net proceeds, and type the net amount on the check, which is part of the account sale. In one office where this kind of machine was installed, one-third of the office labor was eliminated.

The constant turnover in labor is a very important factor affecting costs. Here is an auction which normally employs 27 workers. Yet when you check the payroll for a given month, you find they have paid 42 workers--a turnover of 15 employees, which means new men to be broken in at every sale.

Auctions need measures and standards of business performance and efficiency. Agencies which are represented here can help materially on such a project.

Market News

Federal Market News Service on livestock prices is, with few exceptions, available only for terminal markets. In some States prices on a few auctions are reported by State agencies. Most information available on the larger auctions is from the Federal-State Market News Service.

There is extensive Federal-State coverage in south Georgia, Alabama, and Florida. Georgia and Florida reporters are supervised from Thomasville, Ga. A few auction markets are reported by the Federal Service in Western States, including California, Montana, and Utah, and in the Southwestern States of Arkansas, Oklahoma, and Texas. Purdue University has requested Federal assistance to report local markets in Indiana, but funds have not yet been made available.

Where market operators report prices, there are likely to be too many different interpretations of grades. The trained reporter who visits each market 3 or 4 times a month and relies upon local people to report to him by telephone seems to be the most successful.

A Look Ahead

What does the future hold for livestock auctions? As we have studied and worked with auctions in all sections of the country, I have come to the conclusion that we have about reached a peak of auction numbers in the United States. In some areas there may be a slight increase in numbers, but these will be offset by a reduction in other areas.

In many sections there are too many auctions with small volume--volume not sufficient to attract enough slaughter buyers and buyers of stocker and feeder animals.

As farmers better understand marketing methods and the operation and play of competitive forces and market values, they will overlook the convenience of having a so-called market near their farms and patronize a market where competent and efficient services are rendered and where livestock is given a good workout and sells in line with true market values.

Many of the small auctions will go the way of livestock shipping associations and the multitude of small dairy plants. For example, the total number of dairy plants in Wisconsin dropped from 2,274 in 1950 to 1,731 in 1955. These included creameries, cheese factories, condenseries, etc. Only processed cheese plants increased from 15 to 17. The first auctions to go will be the small operations averaging $15,000 to $20,000 in sales per week, where the principal buyers are auction owners and speculators who purchase the stock and truck them to a large market for sale.

The aggressiveness and business acumen of many larger auctions will be a factor contributing to the reduction in number of smaller auctions. Many larger auctions are expanding their territories and increasing their business volume. With increased volume of business, they improve their facilities, attract more buying competition, and get better auctioneers and more trained and specialized help. Furthermore, they are able to give producers more help in their production, marketing, and livestock improvement programs.

RECOMMENDATIONS OF WORK GROUP

Clifton B. Cox, Indiana, Chairman
Claude R. Underwood, West Virginia, Secretary

Auction markets have increased in numbers and in percentage of livestock handled. The number of markets probably will remain at about the same level. Although some new auctions will be established, others will go out of business.

Considerable improvement can be made in the facilities of auctions for handling livestock. Consideration must be given not only to hours saved but also to seconds. Management of auction companies must be efficient, must recognize problems, and must do something about them.

Assistance on regulations should be given to market operators. Some consideration may be given to additional regulations needed in bonding traders as well as market operators and to regulations in licensing which might include adequate facilities and proper trading practices. An attitude of help should be taken instead of one of condemnation or regulation.

Operations and regulations should be coordinated, and might include assistance in pointing out desirable facilities required.

Market news services must be improved so that more information on prices and supplies at the various markets will be available to the farmer at local levels. Market reports should be specific and should interpret the actual happenings at the markets.

REDUCING COSTS OF HANDLING MILK

Charles E. French, Department
of Agricultural Economics,
Purdue University

To cover completely and without bias such a broad subject as reducing costs of handling milk would seemingly be a logical objective for me. However, to accomplish that objective is obviously impossible. Thus, I will hit only some high spots of research in this area.

I will be guided primarily by what I consider to be timely, practical, important, and feasible in programs which you have as I understand them. I will bias the discussion in the direction of fluid milk, the Midwest, and my own research interests. I will rationalize this bias to some degree as being the most expeditious means of illustrating the material available in this broad area. I will neither review all of the good research in the area nor give a completely unbiased view of what I review.

My discussion will emphasize research designed to help dairy farms and marketing institutions adapt to changing technology. I shall make a few exploratory remarks on "Research Areas to Watch." Finally I shall append a list of "Some Usable Publications." These publications make an unusual list (especially for a researcher). They are listed because they are generally readable, represent regional thought in many cases, and bear somewhat on the particular remarks I want to make today. Most problems discussed are attacked, at least in part, in studies reported in the appended publications.

Research to Help Farmers and Plant Operators Adapt to Changing Technology

Procurement. Of course, the major technological innovation here has been the advent of bulk milk handling. This method was introduced in California in 1938. Soon after World War II it spread to smaller farms, first in Connecticut and South Carolina and later throughout the whole country. Adoption of the method has been rapid and is well past the experimental stage. Undoubtedly, it can already be classified as one of the greatest innovations ever to hit the industry.

Market service organizations can do much to bring greater savings from the bulk handling method. This method has potential savings if the milk is properly handled. If improperly handled, it can mean economic burdens on many marketing institutions and farmers. One segment of the market cannot ignore this innovation. For example, can-hauling rates may skyrocket as the bulk program develops (table 2)

Probably the easiest way to consolidate and integrate the research in this area is to view it from the farmer's eyes. First, he wants to know his costs for the system and then the possible savings he may expect from it.

His costs will be relatively high. Probably his minimum expenditures will exceed $1,000 and may go above $3,000 on many Midwestern farms. These costs

have been surveyed from time to time by the researcher, but the farmer does not need much help in getting at them. The possible savings are what puzzle him.

Table 2.--Can-hauling rate increases as bulk program develops with random producer adoption, a selected Indiana market, 1953

Producers using bulk tanks	Increase in can-hauling rates	
	With can routes consolidated as rapidly as possible	With no consolidation of can routes
Percent	Percent	Percent
5	4	5
10	11	12
25	22	35
50	56	114
75	177	252

Savings to the farmer are of two types. Possible direct savings may be made in milk, labor, electricity, can costs, and fat tests. Indirect savings may come in lower hauling rates and dealer premiums. Most farmers can evaluate the direct farm savings for prevailing conditions from present research. These will usually amount to 5 cents, or possibly somewhat more, per hundredweight.

Possible hauling reductions and plant premiums are a different story. Here the type of market program developed will make a big difference. Greatest hauling savings will come from every-other-day pick-up and complete market planning of routes. Daily pick-up, with each plant developing its own routes from random producer adoption, will probably increase hauling rates. A well-planned program may give hauling savings of 5 to 10 cents per hundredweight, but it is difficult to see much greater savings (table 3).

Table 3.--Hauling rate changes for every-other-day bulk pick-up instead of can pick-up, one selected Indiana market, 1953

Producers using bulk tanks	Change in bulk-hauling rates over present average can-hauling rates if:	
	All producers were routed together	Each dairy developed its own program
Percent	Percent	Percent
5	+56	+147
10	+19	+ 57
25	- 2	+ 10
50	- 7	None
75	-13	- 6
100	-10	- 5

Several large cooperatives and proprietary dealers are trying to develop overall market programs. The plan is usually directed toward securing 100 percent bulk pick-up in the area of one plant, and then proceeding to do the same thing for the area of another plant. Generally, in such programs all farmers are guaranteed premiums by the plant until their tanks are paid for. The plant, in return, is able to effect receiving savings by shifting directly to bulk receiving without having a long, indefinite transition period in which it must maintain both can and bulk receiving facilities.

Bulk tanks will greatly reduce plant receiving costs only after the plant gets 100 percent bulk. Often a small plant can change to bulk more easily than the large one. Thus, the large one must work toward this planned program or face losing its larger producers to the smaller plants in its area.

Producers can expect dealers to be interested in bargaining for a premium over the next few years if producers, in return, are willing to guarantee the plant that it can get 100 percent bulk. The amount of these premiums will vary from market to market. However, research has generally shown that receiving costs can be reduced by shifting from can facilities to bulk facilities. In many markets dealer premiums currently being paid range from 10 to 15 cents per hundredweight. However, these premiums, in some instances, may include some hauling savings.

Initial bargaining of producer groups with dealers for a longtime contract on such premiums would suggest that dealers feel they can maintain such premiums over the life of the farmer tank. The amount of the final premium, in many cases, must be decided at the bargaining table. However, there seems to be merit in having the producer and dealer arrive at a longtime contract which will assure the producer that he can pay for his tank, and the dealer that he can eliminate his can-receiving rooms. Thus, the same planned program may assure both hauling reductions and dealer premiums.

Once the farmer knows these savings, it does not take much pencil pushing to see how he comes out. All he has to do is divide his annual savings by the expected depreciation rate, plus about 5 percent capital use cost for hidden charges of interest, repairs, taxes and insurance, and he can find the amount he can lay out, initially, for his bulk system.

Research in this area is now available in nearly every State. The references appended will give a good start in evaluating local conditions.

Plant and distribution. The greatest problems of adapting to changing technology arise because of widening procurement and marketing areas. This is especially true of fluid operations. Manufacturing operations also feel this impact, but here it is an older story and the adjustment is often more in relocation than in a given individual firm adaptation. Consolidation may figure heavily in both instances.

The feasibility of using paper cartons and of selling milk through stores both have figured prominently in widening fluid markets. A good study illustrating this point was recently completed by the North Central Regional Committee

on Dairy Marketing Research. It illustrated well that the old concept of fluid supply and distribution area characterized as small "islands surrounded by a sea of manufacturing milk or as small oases in a desert that had no milk at all" was archaic. Five-sixths of the plants studied distributed milk out of their local market. Nearly one quarter of them reported that they distributed at least 100 miles away, and more than one-half said they went 50 miles or more.

Researchers have attempted to find means by which plants can adapt to this change. Generally small plants have about 5 alternatives: (1) To go to a straight glass operation with a delaying action on wholesale, (2) to buy paper equipment and try to compete at both wholesale and retail, (3) to secure custom packaging of its own supply, (4) to handle another dealer's paper, or (5) to accept a distributorship. Under certain circumstances each of the above may work, but timing is especially important and each should be evaluated before a final choice is made.

Large plants generally are driven to consider seriously expansion of total volume or a choice between all paper or all glass. Plants may now be better located in regard to resources than to markets.

Proper selection of product mix and distribution method may not always solve the problem. A recent study by the speaker and James C. Snyder using an electronic digital computor so that many variables could be included in the problem solution suggests that proper balance in production resources may be more important in many cases than proper product mix.

Engineering-economic studies such as those by Bressler in New England, Hall at Michigan State, Cook at Wisconsin, and Carter at Vermont, and those we have done here at Purdue point up the huge potential for improved operating efficiency. In nearly every case labor savings of substantial size have been possible. Marketing service organizations will find it difficult to take these results and apply them wholesale to their own State problems. However, this work is demandingly practical and, in proper perspective, will supplement market service programs in a rewarding fashion. Method studies are now available on a host of fluid operations, and many of the principles hold equally well in manufacturing operations.

Scale figures heavily in many of the adjustment problems. Bressler did the original research on economies of scale in country receiving plants and small pasteurizing fluid plants. The market economies of scale in the small volume ranges have been upheld in several later studies. However, studies such as the New York State Commission study have suggested that the medium size fluid operation may give lowest cost. It gains on the large plant on loadout and storage operations and on the small plant in processing efficiency. Bulk tank delivery will tend to give the small plant some relative improvement in this respect. Bulk tanks will tend to solve the problem of small-scale country plants by replacing them.

Traditionally fluid operations were thought to have only intrafirm economies of scale, but recent developments of bulk tanks, paper container

intermarket movements, etc., certainly give them some interfirm economies now which favor chain organizations.

Manufacturing operations seem to continue to grow. Studies such as the Western regional study on butter-powder plants and Rowe's work on cheese plants in Oregon suggest that manufacturing operations will continue to grow. If manufactured products return to free market pricing, plant flexibility will stimulate larger organizations.

Researchers do not have the final answers on optimum size plants. Yet it appears that many plants are too small unless they have unique operating methods or market outlets. Consolidation will continue, and in most cases efficiency, at least in the technical sense, will be improved. Where organizations are confusing other social with economic objectives of plant operation, they should be given assistance in differentiating between them. This assistance seems needed especially in small cooperatives.

Research Areas to Watch

Research of the next few years will give some interesting and useful answers to problems arising from:

1. New uses for milk (especially nonfat portions). Watch especially fresh concentrate, low-fat, and products suitable for foreign trade outlets.

2. Automation.

3. Bulk handling (market-wide programs).

4. Intermarket movement (producer shifts, area orders, standardized quality regulations, surplus disposal systems, and transportation innovations).

5. Competitive structure (plant failures, pricing policy, and plant evaluation).

Some Usable Publications

Procurement

1. French, Charles E., and James R. Strain, "Bulk Milk Handling Needs Planning," Economic and Marketing Information, Purdue University, April 18, 1955.

2. "Special Issue - Bulk Pickup," Milk Plant Monthly, May 1955.

3. Agnew, Donald B., "Selected References on Bulk-Milk Handling," USDA, AMS-22, March 1955.

Plant and Distribution

1. Conner, M. C., et al., "Specifications and Costs for a Milk Pasteurizing and Bottling Plant," Station Bulletin 463, Virginia Polytechnic Institute, 1953.

2. Walker, S. H., et al., "An Economic Analysis of Butter-Nonfat Dry Milk Plants," Research Bulletin 20, University of Idaho, June 1953.

3. Hirsch, D. E., "Estimating the 'Market Value' of a Milk Distributing Business," FCS General Report 3, April 1954.

4. French, C. E., "Work Simplification in the Dairy Plant," Cherry-Burrell Circle, March-April 1952.

5. Page, C. M., and S. A. Walker, "Building Designs for Dairy Processing Plants," Station Bulletin 297, University of Idaho, June 1953.

6. "The Spread Between Farm and Consumer Milk Prices in New York State Markets," New York State Legislative Document (1951) No. 34, Part 3, 1951.

7. "Outer-Market Distribution of Milk in Paper Containers in the North Central Region," Station Bulletin 600, Purdue University, October 1953.

8. Kirkwood, E. K. and J. H. Blackstone, "Merchandising Dairy Products in Alabama Retail Food Stores," Station Bulletin 294, Alabama Polytechnic Institute, May 1955.

9. Bressler, R. G., Jr. City Milk Distribution. Book-Harvard University Press, 1952.

10. Cook, Hugh, "Paper Packaged Milk in Wisconsin," Research Bulletin 179, University of Wisconsin, June 1953.

11. Roberts, J. B., and C. C. Erwin, "Kentucky's Bottle Milk Industry," Bulletin 625, University of Kentucky, June 1955.

Others

1. "Regulations Affecting the Movement and Merchandising of Milk," Marketing Research Report 98, U.S.D.A., June 1955.

2. Dahlberg, A. C., et al., "Sanitary Milk Control and Its Relation to the Sanitary, Nutritious, and Other Qualities of Milk," Publication 250, National Academy of Sciences - National Research Council, 1953.

RECOMMENDATIONS OF WORK GROUP

Harvey J. Weavers, Wisconsin, Chairman
V. C. Manhart, Indiana, Secretary

Among the major developments now underway which show promise of reducing the cost of handling milk, or which should be evaluated in this respect, may be listed the following:

1. Bulk handling of milk on farms, in transportation to processors, and in the receiving operation at dairy plants. The need of a well-planned program on a market-wide basis is indicated for significant reductions in costs.

2. Automation by electronic control of processing operations. Labor-saving possibilities are possible in small as well as in large plants.

3. Intermarket movement of fluid milk, with consequent producer shifts, area orders, standardized quality regulations, surplus disposal, and transportation innovations.

4. New uses for milk. New uses may be expected to become of increased importance to the economy of the industry, particularly in regard to fresh concentrates, products suitable for foreign trade, and those with low-fat contents.

5. Changes in the competitive structure of our markets including pricing policies, plant failures, and evaluation.

We recommend that service agencies watch for releases on research being done in these areas. Such work should prove fruitful by providing answers to problems arising from technological innovations and point the way to new opportunities of reducing costs in handling milk.

GRADING GRAIN AND OILSEEDS

GRAIN AND OILSEED STANDARDIZATION INVESTIGATIONS

Lawrence Zeleny,
Standardization and Testing Branch,
Grain Division, Agricultural Marketing Service,
U.S.D.A.

Under the United States Grain Standards Act official standards have been established for wheat, corn, barley, oats, rye, grain sorghums, flaxseed, soybeans, and mixed grain. For the purposes of the Act, the oilseeds, flaxseed, and soybeans are considered to be grain, and will be so considered in this discussion. Inspection of grain under the U. S. standards is mandatory whenever grain is shipped by grade in interstate commerce from or to an established inspection point, or whenever grain is exported by grade.

Several grades have been established for each kind and, in some instances, for separate classes of a single kind of grain. Grades are based on several different factors and reflect differences in purity, condition, and quality. Grading factors are either judged subjectively or measured by simple physical tests. Typical grading factors are test weight per bushel, moisture content, damaged kernels, and foreign material.

For practical application under all circumstances in which grain must be inspected, it is necessary that the standards be kept simple so that the grade of any lot of grain can be established within a few minutes. Many hundreds of cars of grain are often inspected at a single point in one day by limited personnel. Because of this need to keep the standards simple, it has not been possible to include in them various factors of quality that would make them more useful to the trade. The grain trade, however, is rapidly becoming more quality-conscious and is requiring more detailed quality evaluation of the products it handles. At the same time wider variations in grain quality are occurring largely as a result of the introduction of many new varieties and the broadening of the areas in which certain grains are produced.

If our grain standards are to keep pace with the needs of the trade, and maintain their present usefulness, it will be necessary eventually to incorporate into them factors that measure certain important qualities that are considered impractical of measurement in routine inspection as it is practiced today. To accomplish this, it will be necessary in many instances to develop relatively simple and rapid tests that will reflect the desired quality factors and at the same time will be practical for use in routine inspection. It may also be necessary eventually to employ more and better trained personnel in order to perform the somewhat more intricate and time-consuming tests that may be required in the standards of the future. Grain standardization research activities of the U. S. Department of Agriculture consist in part in the development of rapid and simple tests for measuring those important factors of grain quality that are reflected inadequately or not at all in the present U. S. standards. Some of the work along these lines now in progress will be summarized briefly.

Moisture Content

Moisture content is an important factor in evaluating grain not only because of its direct relation to dry matter content but also because of its influence on keeping quality. Moisture content requirements are in all of the grain standards and are based on prescribed oven methods or "by any device and method which give equivalent results."

Because of the time required by these oven methods a relatively rapid distillation procedure was devised and used for grain inspection (2). 5/ Later an electrical moisture meter for testing grain was developed through the combined efforts of the Department and an electrical equipment manufacturer. This meter

---

5/ Numbers in parentheses refer to "Literature Cited," pp. 132-34.

has almost completely replaced the slower distillation method in grain inspection work. The meter measures the electrical conductivity of grain as it passes between two corrugated steel rolls. Since the conductivity is closely related to the moisture content, the moisture content is determined from conversion tables that have been prepared by the Department. Different tables are required for each kind and, in some cases, for each class of grain. The relation between moisture content and conductivity for any kind of grain may gradually change from year to year because of changes in the varieties of grain produced and in methods of handling the crop, climatic factors, and other causes. For this reason the Department finds it necessary to maintain a continuous check on the reliability of the moisture conversion tables and to revise them when circumstances warrant.

Many other electric and other kinds of grain moisture-testing devices have been developed, and several new ones generally appear on the market each year. The more promising ones are studied and tested by the Department to determine if they have any advantages over moisture-testing equipment now in use in inspecting grain.

Grain Soundness

All grain undergoes deterioration with age. This process may start even before harvest when climatic conditions are unfavorable. Deterioration may be so slow as to be almost imperceptible when conditions of storage are ideal, or grain may completely spoil within a few days when stored under improper conditions. Moisture content and temperatures are the two principal factors affecting the rate of deterioration of stored grain.

Degrees of soundness or deterioration in grain are reflected in the standards by the percentage of damaged kernels present (determined by handpicking) and by the presence or absence of musty or "sour" odors. All of these criteria of soundness are strictly subjective and depend upon the judgment or olfactory acuity of the inspector. They do not provide fully satisfactory measures of degrees of soundness, since a determination of the percentage of damaged kernels provides no index of the severity of damage in the damaged portion or of the relative soundness of the undamaged portion, and since musty odors are associated with some but not all fungi that attack grain.

Studies have been made by the Department of the various chemical changes that occur when grain deteriorates in storage, most of which results in the formation of certain acids (15, 16). It was shown that of the 3 principal classes of acids formed, the free fatty acids resulting from the enzymatic breakdown of the grain fat, increase much earlier in the deteriorative process and provide a more sensitive measure of deterioration than either of the other classes or than all classes of acids combined. A method for determining the free fatty acid content of grain, known as the "fat acidity test" has been developed (1, 16) and has come to be recognized as a useful index of the overall degree of soundness for most grains. Fat acidity is defined as the number of milligrams of potassium hydroxide required to neutralize the free fatty acids in 100 grams of grain, calculated to a moisture-free basis.

Studies have been made over a 3-year period of the fat acidity levels characteristic of freshly harvested sound grain and related commodities in order to establish fat acidity levels below which unquestionable soundness can be presumed and above which at least incipient deterioration is indicated (9). The fat acidity limits so established are shown in table 4.

Table 4.--Fat acidity limits below which unquestionable soundness can be presumed

Product	Fat acidity value
Wheat	20
Corn	22
Barley	25
Rye	22
Grain sorghums	25
Soybeans	22
Beans	10
Peas	10

Relatively very high fat acidity values are obtained for badly deteriorated grain. Wheat, for example, may attain fat acidity values of over 100 and corn as high as 250.

Currently, the Department is developing a rapid fat acidity test that it is hoped may prove useful in routine grain inspection and may eventually be used as a grading factor. The grain is ground and the fat and free fatty acids extracted with a solvent in the closed chamber of a specially constructed high-speed laboratory mill. The solvent containing the fat and fatty acids is then filtered and a portion of it titrated. The whole procedure requires only about 10 minutes and should provide a simple and rapid means of estimating objectively the relative soundness of different lots of most grains.

Bread-Baking Quality

The potential bread-baking quality of wheat varies over an extremely wide range, but these important differences in quality are not reflected to any great extent in the U. S. standards. In the two principal classes of wheat used for bread flour production, subclasses have been established on the basis of kernel texture. Since the percentage of "dark, hard, and vitreous" kernels correlates roughly with protein content, which, in turn, is an important factor affecting bread-baking quality, the standards to this extent reflect differences in bread-baking quality.

Bread-baking quality is influenced by many different factors, some of which are not well understood. The most important factors, however, are the quantity and the quality of the gluten protein in the wheat. Both of these factors vary widely. Gluten content depends primarily on climatic and soil conditions.

Gluten quality is largely a varietal characteristic although the quality of gluten in varieties of wheat that normally have good quality gluten is sometimes seriously injured by hot, dry weather prior to harvest. The conventional method for determining protein (or gluten) content is not considered practical for incorporation into wheat standards. Gluten quality is usually evaluated only by actual bread-baking tests or by means of mechanical dough-testing devices. None of these methods could possibly be applied to routine grain inspection.

Two relatively simple methods for determining the protein content of wheat have been developed by the Department. A photometric method (11, 18) is based on the photoelectric measurement of the turbidity produced when a buffer solution is added to an alkaline suspension of wheat protein. This method is essentially a measure of gluten protein, and with it a relatively large volume of work can be handled with a single set of rather simple equipment. The other method is based on the photoelectric measurement of the color produced by the biuret reaction (8), and since it depends on a reaction involving the peptide linkage characteristic of all proteins, it may be a more accurate measurement of true protein than the conventional Kjeldahl method, which is in reality a measure of nitrogen content only. Neither the photometric nor the biuret method can be used alternatively with the conventional Kjeldahl procedure, but results obtained with both of them usually correlate very highly with Kjeldahl results, the coefficients of correlation usually being higher than 0.95.

The Department has more recently developed a simple, rapid sedimentation test for wheat, the results of which depend primarily on the quantity and quality of gluten present (12). A small weighed portion of a quickly produced flour is mixed in a graduated cylinder with water and lactic acid. This treatment causes part of the gluten to swell by imbibing water after which it slowly settles toward the bottom of the tube leaving a clear-cut line of demarcation between it and the supernatant liquid. The level to which the swollen gluten has settled in a 5-minute interval is taken as the sedimentation value and depends partly on the quantity of gluten present and partly on the extent to which it has swollen. This swelling capacity of gluten appears to be closely related to its quality for bread-baking purposes.

Tests on many hundreds of samples of wheat over a period of several years have demonstrated a rather high correlation between sedimentation value and bread loaf volume, one of the important factors considered in an evaluation of bread-baking quality. Correlation coefficients of between 0.7 and 0.9 have usually been obtained. The sedimentation test appears to be as good an index of bread-baking quality as any other known single test, other than an actual bread-baking test, and a better measure than any other known test of comparable speed and simplicity. However it cannot be considered as an accurate measure of bread-baking quality, but rather as a rough measure by which wheat can be classified in a general way in accordance with its potential bread-baking quality. The sedimentation test has been modified several times and is still being subjected to research. A description of the latest modification is available in multilithed form (10).

Table 5 shows how wheat might be classified by means of sedimentation values.

Table 5.--Suggested classification of wheat of the species Triticum vulgare and T. compactum according to sedimentation value

Sedimentation value	Wheat characteristics	Suggested use
60 and over	Hard wheat High protein content Strong gluten	Mixing with weaker wheat for bread flour production
40 - 60	Hard wheat At least moderately high protein and moderately strong gluten	Bread flour production, straight or after some mixing with weaker wheat
20 - 40	Hard wheat Low protein or weak gluten	Mixing with stronger wheat for bread flour production
Less than 20	Soft wheat	Cake, cookie, pastry and biscuit flour

Oil Content and Quality

Flaxseed and soybeans are used principally for the production of oil, yet the U. S. standards for these oilseeds do not reflect appreciably the differences that occur in oil content and oil quality. Conventional methods for determining oil content and oil quality in oilseeds are much too time consuming for use in routine inspection.

A refractometric method for determining the oil content of flaxseed and soybeans was developed (3) and later refined (14, 17) by the Department. With this method a small weighed portion of the finely ground seed is further ground in a mortar with a measured portion of an oil solvent of high and carefully standardized refractive index. Since the refractive index of the seed oil is much lower than that of the solvent, the refractive index of the filtered mixture of oil and solvent is used as a measure of the oil content of the seed. Results agree very closely with those obtained by the standard extraction procedure, and the test requires only 30 minutes as compared with from 5 to 16 hours for the standard method.

More recently the Department, in cooperation with a manufacturer of electronic equipment, has developed a dielectrometric method for determining the oil content of soybeans, (4), flaxseed (5), and of sunflower seed and safflower seed (7). The method is based on the principle that varying quantities of oil, when mixed with a solvent of fixed dielectric constant, produce proportional changes in the dielectric constant. The seed is ground in the closed chamber of a special high-speed mill in the presence of an oil solvent of carefully

standardized dielectric constant. The mixture is filtered and the dielectric constant of the filtrate determined electrometrically. The oil content is then read from a prepared conversion table. Results obtained are in good agreement with those obtained by the standard extraction procedure, and the time required for the test is about 15 minutes. The test is better adapted to routine work than the refractometric method.

Iodine number, a chemical measure of degree of unsaturation, is one of the most important quality factors for flaxseed since it varies widely among different varieties and within the same variety as a result of climatic differences during the growing season. High iodine number oils are superior for paints and varnishes because of their more rapid drying properties. Iodine number in soybeans oils is considerably less variable. However, high iodine number soybean oils are preferred for paint use, and low iodine number oils for food use.

Research in the Department has resulted in the finding that a remarkably close relationship exists between the iodine number and the refractive index of freshly pressed or freshly extracted oil from sound flaxseed (13, 14) and sound soybeans (17). Correlation coefficients of 0.996 and 0.963 were found for flaxseed and soybean oils respectively. Thus iodine number can be determined very quickly by merely pressing a few drops of oil from the seed by means of a small laboratory press and reading the refractive index of the oil with a precision refractometer.

In cooperation with a manufacturer of optical instruments, a special hand refractometer has been developed for this exclusive purpose (6). It is very much simpler and less expensive than the ordinary precision refractometer otherwise required, it reads directly in terms of iodine number rather than refractive index, and the thermometer used for making temperature corrections is calibrated in terms of iodine number units rather than degrees. With this equipment, including the laboratory press, iodine number of the oil in a sample of sound flaxseed or soybeans can be determined rather accurately within 5 minutes.

Summary

The U. S. Department of Agriculture, through its grain standardization and marketing research activities, is engaged in developing simple and practical tests for measuring important factors of quality in grain. Rapid tests for moisture content, soundness, gluten content and quality, and oil content and quality are briefly described. Tests of this kind frequently prove to be of considerable value to various elements of the grain trade. The ultimate objective of this work is to improve the effectiveness of the official grain standards of the United States by incorporating into them various important indexes of quality in forms that can be readily applied in routine inspection.

Literature Cited

1. Association of Official Agricultural Chemists. Official Methods of Analysis. Published by the Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington 4, D. C., 7th Edition (1950).

2. Brown, Edgar, and Duvel, J. W. T. A Quick Method for the Determination of Moisture in Grain. U. S. Dept. of Agric. Bureau of Plant Industry Bull. 99 (1907).

3. Coleman, D. A., and Fellows, H. C. Oil Content of Flaxseed, with Comparisons of Tests for Determining Oil Content. U. S. Dept. Agr. Bull. 1471, 35 pp., illus. (1927).

4. Hunt, W. Haward; Neustadt, M. H.; Hart, Joe R.; and Zeleny, Lawrence. A Rapid Dielectric Method for Determining the Oil Content of Soybeans. The Journal of the American Oil Chemists' Society 29 (7); 258-261 (1952).

5. Hunt, W. Haward; Neustadt, M. H.; Hart, Joe R.; and Zeleny, Lawrence. A Rapid Dielectric Method for Determining the Oil Content of Flaxseed. The Journal of the American Oil Chemists' Society 30 (11): 463-465 (1953).

6. Hunt, W. Haward; Neustadt, M. H.; Shurkus, A. A.; and Zeleny, Lawrence. A Simple Iodine-Number Refractometer for Testing Flaxseed and Soybeans. The Journal of the American Oil Chemists' Society 28 (1): 5-8 (1951).

7. Johnson, Robert M.; Hunt, W. Haward; Neustadt, M. H.; and Zeleny, Lawrence. A Rapid Dielectric Method for Determining the Oil Content of Safflower and Sunflower Seed. Submitted for Publication in The Journal of the American Oil Chemists' Society.

8. Pinckney, Alvin J. Wheat Protein and the Biuret Reaction. Cereal Chemistry 26 (6): 423-439 (1949).

9. U. S. Dept. of Agriculture. Sound Grain Fat Acidity Survey - 1953 Crop. Mimeo. 20 pp. (1954).

10. U. S. Dept. of Agriculture. Sedimentation Test. Multilithed. 4 pp. (October 1955).

11. Zeleny, Lawrence. A Simple Photometric Method for Determining the Protein Content of Wheat Flour. Cereal Chemistry 18; 86-92 (1941).

12. Zeleny, Lawrence. A Simple Sedimentation Test for Estimating the Bread-Baking and Gluten Qualities of Wheat Flour. Cereal Chemistry 24 (6): 465-475 (1947).

13. Zeleny, Lawrence and Coleman, D. A. The Refractometric Determination of Iodine Number in Flaxseed Oils. Oil and Soap 13 (10): 253-256. (1936).

14. Zeleny, Lawrence and Coleman, D. A. Rapid Determination of Oil Content and Oil Quality in Flaxseed. U. S. Dept. of Agric. Tech. Bull. 554, 39 pp. illus. (1937).

15. Zeleny, Lawrence and Coleman, D. A. Acidity in Cereals and Cereal Products, Its Determination and Significance. Cereal Chemistry 15: (5): 581-595 (1938).

16. Zeleny, Lawrence and Coleman, D. A. The Chemical Determination of Soundness in Corn. U. S. Dept. of Agric. Tech. Bull. 644, 23 pp. (1939).

17. Zeleny, Lawrence and Neustadt, M. H. Rapid Determination of Soybean Oil Content and of Iodine Number of Soybean Oil. U. S. Dept. of Agric. Tech. Bull. 748, 22 pp. (1940).

18. Zeleny, Lawrence, Neustadt, M. H., and Dixon, H. B. Further Developments in the Photometric Determination of Wheat Protein. Cereal Chemistry 19 (1): 1-11. (1942).

RECOMMENDATIONS OF WORK GROUP

John Winfield, North Carolina, Chairman
John Mahoney, Maryland, Secretary

Gratifying results have been developed in the following areas:

1. Fat acidity test for grain soundness.

2. Sedimentation tests of wheat for bread-making quality.

3. Refractrometic determination of iodine numbers as a reflection of oil quality in soybeans and flaxseed.

4. Advancements in rapid moisture testing devices.

5. Dielectrometric determination of oil quantity in soybeans and flaxseeds.

If our grain standards are to keep pace with the needs of the trade and maintain their present usefulness, it will be necessary eventually to incorporate into the standards factors that measure important qualities, such as grain soundness, bread baking quality of wheat, and oil content and oil quality of flaxseed and soybeans, which present methods of determination are considered impractical of measurement in routine inspection as it is performed today. Research is making notable progress along these lines that may be incorporated to advantage in the standards when the trade recognizes their practicability.

Marketing service personnel should promote the use of Federal grades throughout the United States with particular concentration in areas where grain is not bought and sold on grade basis. Some ways of doing this job, as suggested by the work group, are:

1. Inspectors and graders can be given individual assistance at the various grain markets.

2. Training in inspecting and grading of grain should be given to employees of grain marketing facilities where official inspectors and/or grades are not established.

3. Grading demonstrations can be given at group meetings of farmer, trade, and other organizations.

4. Where applicable, results of research now available should be instituted throughout our grain marketing channels.

REDUCING COSTS OF HANDLING FRUITS AND VEGETABLES

Joseph F. Herrick, Jr.,
Transportation and Facilities Branch,
Marketing Research Division,
Agricultural Marketing Service, U.S.D.A.

The purpose of this work group meeting is to discuss methods of reducing costs of handling fruits and vegetables and how to get them adopted. Later in this discussion, I shall point out some of the research that has been done in three areas: (1) Methods of reducing the cost of receiving, packing, and handling produce at country assembly points and packinghouses; (2) results of research to determine the least costly methods of moving fruits and vegetables into, within, and out of wholesale warehouses; and (3) savings that can be made through improved marketing facilities.

In moving fruits and vegetables from the farmer to the consumer, it is estimated that these products are picked up, moved, and set down 30 or more times. It takes 65 percent of the consumer's dollar for fruits and vegetables to pay the costs of moving the produce to him. Of course, these costs include profits, but profits comprise a small part of the total. The lion's share goes for handling the product--for harvesting it; moving it from field or orchard to the packinghouse or storage place; packing or preparing it for market; loading it into transportation equipment and moving it to the market; unloading and placing it in storage at the terminal market or warehouse; loading delivery trucks and transporting to retail store, hotel, restaurant, and other outlets; unloading the delivery truck at the retail outlet; preparing the product for retail sale; and checking it out to the consumer. All of these operations add to the cost of the product, and it is at these various steps in the marketing channel that we should direct our attention to find ways of reducing costs.

There are three ways to attack this problem of cutting costs: (1) By building new facilities or improving the old ones; (2) by improving the methods used for moving and preparing the product for the consumer; and (3) by developing new equipment or adopting improved equipment for the various marketing operations.

The Transportation and Facilities Branch of the Marketing Research Division in A.M.S. engages in a wide variety of activities in planning and promoting the construction of improved marketing facilities for all kinds of farm and food products throughout the country. The work is done in cooperation with marketing agencies and State or municipal institutions. When work is undertaken in any locality, a complete study of existing facilities and methods of handling is made; the volume of products being handled, or likely to be handled, is ascertained; handling costs are determined; and, on the basis of this analysis of

the current situation, a determination is made of the kind, amount, and design of facilities that would meet the needs. If satisfactory facilities can be provided at reasonable cost by improving the facilities currently in use, perhaps by removing obstructions to the smooth flow of the product through the facility or by changing structures where possible to eliminate labor or permit use of new and improved types of equipment, such action is recommended. If not, a complete new layout for new facilities is drawn up, providing proper doors, platforms, floors, ceiling heights, etc. The new facilities are planned to accommodate best known methods and equipment for moving produce into, within, and out of the facilities, and to provide for future expansion. Facilities for all types of farm and food products are planned at all stages of the marketing channel including large city wholesale markets, warehouses, livestock auctions, elevators, packing and shipping sheds, farmers' markets, egg assembly plants, etc.

The handling of farm and food products at each stage in the marketing channel requires thousands of workers and millions of man-hours of labor. To handle the increased volume of products needed to supply an expanding population, which demands both additional goods and services, unnecessary handling operations must be eliminated, and labor must be provided improved methods and equipment for doing its work, if marketing costs are to be maintained at present levels or reduced. That is, the productivity of labor employed in marketing must be increased just as the productivity of labor on farms has been increased. Meeting this general objective will require improved methods for using present equipment and development of adequate criteria for selecting the proper kinds and amounts of equipment. Also, new equipment must be developed for special handling operations where existing types are not satisfactory.

Research to Reduce Marketing Costs at Country Assembly Points and Packinghouses

Fruit handling, packing, precooling, and storage. A study of apple packing and storage houses, conducted for the U. S. Department of Agriculture by the Washington State Apple Commission under a research contract, revealed that costs could be reduced by adopting improved methods and equipment: 20 percent could be saved by improving methods with currently owned equipment, and 40 percent if new equipment was purchased. Of particular significance in connection with this research was the development of a portable mechanical lift for high-piling and breaking out high-piled boxes of fruit in plants that normally use manual methods for performing these operations. A plant with a 250,000-box capacity could save $1,750 per year on this operation. Developmental work centered around innovations in work methods and operating procedures using existing equipment, and on the development and testing of improved equipment and devices that would further improve these methods and procedures. This research resulted in several outstanding findings. Some of these are:

1. Gravity-type roller conveyors installed on the truckbeds reduced receiving time per 1,000 boxes of apples from 1.5 man-hours to 0.27 man-hour.

2. Forklift truck trailer trains for moving fruit from storage to the packing line reduced costs from $5.66 per 1,000 boxes where forklift trucks were used to $3.74.

3. In the older multi-story houses, the 24-box capacity industrial clamp-type lift truck reduced costs from $20.79 per 1,000 boxes where hand trucks and belt conveyors were used to $12.78.

Studies of packing room operations were conducted for the purpose of checking the performance of currently used methods and equipment and to develop plans and specifications for improved equipment. In checking the performance of sorting tables currently used, studies were made of the comparative labor and equipment costs by use of three types of equipment: (1) Belt-type sorting table, (2) spiral-roll table, and (3) reverse-roll table.

These studies showed that the reverse-roll table, which rotates the fruit as it is moved past the inspectors, has the greatest possibilities for effecting economies in the use of sorting labor. Accordingly, work was undertaken to improve this table. Improvements made consisted of dividing the table into lanes and assigning responsibility to individual graders for certain lanes.

A new sorting table, known as the "float-roll" table, was developed which should make possible significant savings in fruit sorting operations through reduced crew size, reduced work, and increased capacity. Use of this new table has cut labor requirements for the operation by 50 percent without any effect on the quality of the fruit.

A new type transverse-roll sizing table sizes fruit much faster than the old type, and reduces the amount of space and equipment required for this operation.

Two accumulator-packing station devices were developed. One of these, a system of return-flow belt conveyors for accumulating fruit, makes use of the existing sizing equipment more efficient, permits new packing room layouts which require less floor space, and makes possible the use of both automatic and semi-automatic packing equipment for tray pack fruit. The other, an automatic box filler, almost eliminates the need for labor in connection with the loose box filling operations. Two hundred box fillers have been manufactured by one firm and installed in apple houses in the Pacific Northwest. Tests and cost studies show that this device saves an average of about $4\frac{1}{2}$¢ per box on labor costs compared with the manual-scoop method usually employed.

In cooling rate studies, the cooling performance obtained with various types of containers and packing methods has been compared with that obtained with the standard wrapped pack in a wood box. Pears wrapped and packed in wood boxes with polyethylene liners cooled as readily as did similar packs without liners. A similar situation was found when apples were packed in a cell-type carton with and without liners. These observations indicate that a standard wrapped pack can be placed in a liner without much effect on the rapidity with which the package will cool. There was little difference in the cooling performance of tray-packed apples in cartons with only the top layer wrapped and the standard pack

in a wood box. Perforation of the trays did provide some improvement in the cooling of the tray pack. Tests showed that wrapped cell-pack cartons cooled slower by 25 to 20 percent than the standard wood box wrapped pack. Other tests indicated that when multiple thickness cartons are used to provide maximum container strength, they should be stacked in such a way as to provide good exposure to air circulation on both sides of the box.

Tests made to compare the cooling of unpacked fruit in field boxes with and without polyethylene liners showed that boxes without liners cooled in one-third the time required for those with liners. A great deal of the difference between the cooling of packed and loose fruit is due to the ability of air currents to pass through loose boxes rather steadily.

To test the response of apples to storage in various atmospheric conditions, three modified atmosphere test cabinets were constructed, and apples were stored in atmospheres of (1) 3 percent oxygen and 2.5 percent CO_2, (2) 3 percent oxygen and no CO_2, and (3) 5 to 6 percent oxygen and no CO_2, when fruit was held at 30 to 31° F. Fruit deteriorates less under the first two conditions than under the last condition or under ordinary atmospheric storage at 31° F. However, fruit flavor was altered by modified atmosphere treatments, the fruit having a sharply acid taste when removed from storage.

A pilot model of a high velocity cooling system for cooling packed soft fruits on a conveyor prior to lidding was constructed and tested for use with various fruits. On cherries, packed in 15-pound row-faced lugs, the operation was very successful, removing the majority of the field heat in 15 minutes and cooling to within 3 or 4 degrees of the cooling air temperature in 30 minutes. On apricots, jumble packed in L.A. lugs, about one-half the field heat was removed in 20 minutes, and fruit temperature was within 10 degrees of the cooling air temperature in 30 minutes. Tests made on hydrocooling of cherries show that cooling is about four times as fast as that observed in the high velocity cooling system.

Cooling tests were made on a new storage where the air circulation system uses auxiliary fans to direct the air to portions of the room not covered by primary circulation from the air cooling units. Such an arrangement effects substantial savings by eliminating duct costs, and provides an acceptable rate of temperature reduction for the fruit placed in the storage and an acceptable degree of uniformity in the holding temperature.

Tests made on a storage constructed with a 3-layer pumice block wall (consisting of three 4-inch pumice blocks and two 1-inch spaces filled with vermiculite, which made the wall 14 inches thick) had an overall heat transmittance only slightly greater than a wall insulated with 4 inches of corkboard. In a test on a roof insulated with 4 inches of corkboard directly beneath the roof sheet, it was found that a black roof transmits from 6 to 10 percent more heat to the storage than does an aluminum painted roof.

A considerable number of fruit storages have been constructed without insulation beneath floors placed on the ground. In these storages the temperature

of boxes of fruit placed directly on the floor is higher than that in boxes immediately above. Some work is being done to determine the value of floor insulation for fruit storages.

Potato storage, handling, and packing. Several methods of putting machine-harvested potatoes into bins were studied, and it was found that the retarder gate conveyor was the fastest and caused the least injury to the potatoes. The horizontal conveyor and canvas chute was nearly as fast but caused the greatest injury. Filling ton boxes in the field resulted in 8 percent major injury when no one managed the canvas chute.

Work on fluming potatoes from deep storage bins to washing and packing lines is highly significant because many of the present potato storages and packinghouses have deep bins for storing potatoes, and washing potatoes before packing is rapidly becoming the general practice. Tests on fluming potatoes from the bins to the washer showed that about 75 percent less labor is needed in moving the potatoes, much of the bruising caused by other methods is eliminated, and the job of cleaning up the dirt after the potatoes have been removed from the bins is practically eliminated.

A vertical potato elevator was designed, built, installed, and tested at the Red River Valley Potato Research Center, where it was used to elevate the entire 1953 crop from basement flumes 15 feet to the washing and packing line. This new elevator costs less to build and operate and takes less space than the elevating conveyors it replaced. Indications are that this elevator will be adopted widely in the Red River Valley and in other areas storing potatoes in deep bins.

Preliminary results of washing studies indicate that the length of time the potatoes are wet is the most important factor in obtaining good results. The quantity of water used and the pressure at which it is applied also affects results. These early studies also indicate that it may be more desirable to use brush rolls than the rubber pintle type.

A one-ton pallet box tipper was designed and constructed for filling and emptying boxes independent of a forklift truck. A potato warehouse equipment crane also was designed and constructed for use in positioning potato handling equipment.

Studies of existing sorting tables reveal that the roll-type sorting table is superior to the belt type. Increased output was obtained from a packing line by regulating the flow of potatoes on a uniform basis and adjusting the flow to existing conditions. Where potatoes were packed directly on receipt at the packinghouse, the use of a hopper bin for feeding potatoes onto the packing line was found to reduce significantly the delay between motortruck changes. A conveyor used with the hopper bin offers promise for improving the operation further.

In the storage field for intermediate crop potatoes, it was found that the proportioning and recirculating type of ventilation maintains higher relative

humidity, and stored potatoes lose less weight than potatoes stored in rooms using common ventilation. An air circulation rate of 1/2 cubic foot of air per minute per bushel maintained a lower temperature in the stored potatoes and showed a lower weight loss than the lower rate of 1 cubic foot of air per minute per 4 bushels.

Studies were made in 5 commercial potato storages, with equipment already installed, to compare 5 different arrangements for storing potatoes. The 5 storages were as follows:

1. A 36- by 80-foot aboveground storage having proportioning recirculating ventilation.

2. A 40- by 100-foot banked storage with 2 position ventilation and recirculation.

3. A 36- by 80-foot banked storage using no forced ventilation.

4. A 36- by 80-foot refrigerated cellar type storage.

5. A 40- by 100-foot air-conditioned (15 tons) banked storage.

Of the ventilated storages, method No. 1 maintained the lowest temperatures over a 3-month storage period and was able to provide very uniform temperatures throughout the pile of stored potatoes. The refrigerated storage, No. 4, with no means of using outside air for cooling, was able to maintain slightly lower temperatures than the best proportioned ventilated storage. The air-conditioned storage, No. 5, in which cooling machinery was used in conjunction with dampered outside air, consistently lowered the temperature of the stored potatoes from 55° to 40° over a 4-week period.

Citrus handling and packing. A number of developments have occurred in citrus marketing which should be mentioned here. Research done in California holds promise that lemons, and perhaps later other fruits, will be sorted by use of electronic devices. In Florida, tests are underway to bulk handle oranges into degreening rooms, move them from degreening rooms through the plant, and transport them in bulk to consuming centers or to points for packaging in consumer units. A sorting table is now being tested which carries the product directly toward, or at, the sorters rather than past them from left to right or from right to left.

Research to Reduce Cost of Moving Fruits and Vegetables Into, Within, and Out of Wholesale Warehouses

Receiving. Studies of receiving fruits and vegetables have been underway for a number of years. The use of pallets and forklift trucks by the larger volume dealers has been found to be one of the most efficient methods. However, results of research indicate that smaller volume dealers can do a very effective job with semilive skids and jacks.

If semilive skids are taken directly to the team track, loaded there on the bed of the motortruck, and returned to the store where a jack is used to remove the loaded skids without rehandling of individual packages, about 80 percent of the work normally involved in receiving at the store or warehouse is eliminated.

Systems of positioning loaded pallets for handling by forklift trucks can greatly reduce the labor needed to unload and place merchandise in storage. Other developments include using clamp-type 2-wheel hand trucks, bridgeplates, walking-type lift trucks, pallet dollies, etc.

Loading out. A system of using recording and transcribing equipment to replace the checker in the loading-out crew resulted in a one-third reduction in the cost of loading the trucks of service wholesalers.

Studies were made of six different methods for loading out delivery trucks. Of these 6 methods, the one employing 4-wheel hand trucks was the lowest cost. Its cost was 72 cents less per ton than the highest cost method, and 3 cents less per ton than the next best method. A service wholesaler who loads out 50 tons a day would save $13,000 per year by shifting from the least efficient to the most efficient method.

At the present time studies are underway to develop a pallet loading system for delivering produce which should result in a reduction in handling costs and speed up the loading of the delivery truck.

Banana receiving, ripening, and packing. Research was conducted in wholesale warehouses on the necessary operations for receiving, ripening, and packing bananas. Results indicate that use of the 4-wheel banana truck is the lowest cost method, $29 per carload equivalent; and the manual monorail "ripen-on-carrier" is the highest cost method, $45 per carload equivalent. Wholesalers doing a 300-carload volume per year could save about $5,000 annually by adopting the 4-wheel hand truck method.

Other studies. Work is being continued to develop the lowest cost equipment for different volume dealers. Layouts and designs of service wholesalers' warehouses are being studied, and it is hoped that results from this work will further improve wholesale handling. It is also our intent to evaluate the different types of equipment so that recommendations can be made for dealers with differing volumes of business.

Research to Effect Savings Through Improved Marketing Facilities

Since 1936 the Department has been conducting studies of individual markets. These studies are being continued as time and personnel are available. This work has led to the construction of new markets in many places throughout the United States and its possessions. During the past year new wholesale produce markets were completed or under construction in Houston, San Juan, Raleigh, Louisville, Rochester, and Nashville. The produce market at Miami was expanded, and the new wholesale meat market of Boston which began operating last year was

more than doubled in size. Construction is about ready to begin on produce markets at New Haven, Philadelphia, Richmond, Atlanta, Birmingham, and Milwaukee. New grain marketing facilities were constructed in Kentucky and Georgia, and a number of expansions and improvements in grain marketing facilities were made in North Carolina and South Carolina. All the facilities built over the years on the basis of plans developed as a result of our studies have been successful, and market operators have reported that savings in distribution costs have exceeded expectations.

Initial work is underway to determine the best design for a service wholesale warehouse. This work is needed not only because such warehouses are a part of many terminal markets, but also because other facilities must be designed in such a manner that they can be adapted to the needs of service wholesalers in the future, in view of the trend toward the service wholesale business.

The research work that I have covered in this talk is not by any means all of the work that has been done in the field of reducing costs of handling fruits and vegetables. I have mentioned only some of the research that has been done. Undoubtedly, you know of many other research studies, which I hope will be brought out in the discussion period that is to follow on this subject.

RECOMMENDATIONS OF WORK GROUP

George H. Chick, Maine, Chairman
Kenneth R. Slamp, Pennsylvania, Acting Chairman
Davis Foreman, Illinois, Secretary
Max E. Brunk, New York Consultant

Extent of State activities. Several States represented in the work group are actively engaged in this area of service programs. The principal types of programs reported dealt with:

1. Handling and packing. Some States are working with producers to adapt research findings to the particular needs of the individual operation for reducing costs of delivery and handling of fruits and vegetables to the processing or packing operation. Several States reported work directed toward machinery improvements or modifications to improve packing plant efficiency, reduce bruising damage, and reduce labor costs. It was generally agreed that opportunities exist in this field for substantial reduction in handling and service costs. State service programs can assist by careful observation and reporting of new developments originated by producers and handlers designed to fit particular needs in reducing handling and packing costs.

2. Storages and warehouses. A few States reported work designed to assist storages and warehouses in the adaptation of labor- and time-saving equipment. The work group agreed that substantial cost reduction could be effected in this area.

Program and personnel. It was the group opinion that personnel with industrial engineering training and a sound agricultural background are desirable in this work. A vigorous program of service work in this field was indicated, and it was further recommended that coordination of effort with Extension Service personnel should be effected wherever possible.

EXPANDING SALES OF POULTRY AND EGGS

James M. Gwin, General Manager,
Poultry and Egg National Board,
Chicago, Illinois

My topic, expanding sales of poultry and eggs, was assigned to me presumably by one of that group of unsung heroes who are a part of any successful meeting, namely the program committee. If time had permitted before the program printing date, I would have suggested to the committee the addition of some statement that would have covered holding current sales as well as expanding sales, for experience indicates that in today's extremely competitive market most food industries have to run pretty fast merely to be able to stand still. In other words, competition will quickly cancel out much of the progress already made if promotion effort on behalf of any product is not followed through consistently.

The Poultry and Egg National Board (commonly known as PENB) is the agency of the entire American poultry industry. It is charged with the responsibility of keeping the American public conscious of poultry products and favorably inclined toward them. It has no other assignment. It is comparatively free of rules and regulations. It is controlled only by its budget limitations and by actions that will not harm other foods or reflect unfavorably on any part of the poultry industry.

PENB accomplishes its basic mission in many ways. During the past 15 years it has built a valuable reputation with the food editors of the Nation. Thousands of editors have learned through experience that they can depend upon PENB recipes and pictures. Some of the Nation's leading publications have used every article and every picture that PENB has ever sent them. They have done so because PENB has tried to prepare its material carefully, accurately, and attractively. It has been released in such a way that each publication has an exclusive time and area restriction. This factor often makes it necessary to prepare 7 separate articles and 7 separate pictures covering a single event or single promotion.

PENB does not attempt to handle the entire poultry products promotion program alone. It works with every organization, group, or individual interested, willing, and able to tell the public about our products. A very small portion of the promotional material that reaches the consuming public is identified with PENB, and we are very happy about that situation. We are especially pleased when Federal, State, and local agencies use our material through their own channels of distribution. We like to work with them on promotion programs and often find that the local angle which many of them add to the program gives it much greater coverage.

The poultry industry occasionally gets a very favorable windfall in the way of a picture or an article that will directly or indirectly increase consumption of poultry products in a limited area or even on a nationwide basis. For every one of these, however, there are perhaps a dozen or more that seem like windfalls but that are actually the result of long and careful planning on the part of PENB or one of its fine cooperators.

RECOMMENDATIONS OF WORK GROUP

Tom Fox, Oklahoma, Chairman
Stanely Painter, Maine, Secretary

The group felt that to expand sales of poultry and eggs, marketing service people should:

1. Work closely with the industry and move advertising into new fields such as television.

2. Make available poultry and egg recipes to television and radio stations and the press.

3. Furnish material in color for cover pages of weekly magazines and news articles on eggs, poultry, and poultry products as holiday features.

4. Use more tie-in advertising, especially with foods which complement poultry or eggs.

5. Glamorize the product.

6. Work closely with such agencies as the Extension Service in consumer marketing programs.

7. Endeavor to offer consumer hints and helps constantly, as well as displays; promote ready-cooked chicken, turkey, or duck dinners for all special occasions--not only for holidays but also for dinners after the World Series, football games, etc., or for television dinners.

8. Promote new and better ways, already available, of packaging poultry and eggs.

To expand sales of poultry and eggs, we must maximize returns to producers and provide greatest consumer satisfaction. The original quality of these products must be maintained through all channels of trade. We must keep all buying agencies--that is, institutions, armed forces, and other mass feeding operators--informed of supply.

These and many other fields, both old and new, will constantly offer opportunity to expand sales.

IMPROVING THE HANDLING AND INCREASING THE DEMAND FOR MEAT

D. E. Brady, Department of Animal Husbandry,
University of Missouri

I am very pleased to have this opportunity to meet with you at your 1955 National Marketing Service Workshop. We in the land-grant institutions often have all too little contact with the staff members of our State Departments of Agriculture. It has been my good fortune, however, to have worked rather closely with the Missouri State Department of Agriculture. Had it not been for the interest of Commissioner Carpenter, I would not have been able to be here today.

The subject assigned me is in some respects rather difficult, and I feel somewhat inadequate to do it justice. I am cognizant of the suggestions made with regard to presenting practical research results and at the same time pointing up where marketing service people can assist producers, firms, and agencies. One saving grace is that we have Ray Hoecker here as a consultant. I feel quite confident that he will come to my rescue when needed since he is probably partially responsible for my being on this program.

Some of the information I will present is subject to varying interpretation, which may well serve to encourage the discussion which follows.

Two years ago it was my good fortune to be asked to appear on this campus to speak at a livestock program. The subject was "Can We Produce Hogs With Less Fat." At that time I stated that the title might better have been "Why We Should Produce Lean Hogs." The answer then was, "because we have largely lost our lard market, and we are now losing our market for fat pork." Now just 2 years later, confronted with relatively heavy marketing of hogs and a growing weakness in demand for pork, we find that the hog market is in real trouble. In spite of all the excellent research and fine educational programs, we find that we do not have a hog marketing program that gives the lean meat type hog the recognition it deserves.

As a result of the consumer preference work which we have carried out at the Missouri Agricultural Experiment Station—with the Departments of Animal Husbandry, Agricultural Economics, and Home Economics cooperating—we have repeatedly drawn attention to the fact that consumers want lean pork. When consumers chose the medium grade in preference to the number one grade as they did in our 1953 survey, they were expressing as tangibly as they could the increasing distaste for fat which they and most Americans feel. Involved in the trend away from pork is also the increased consumption of beef and broilers.

We are most favorable to the changes in pork carcass grades. If these standards are to be effective, however, much needs to be done in implementing an improved system of hog marketing. The same applies also on processing and retail distribution levels. In short, what is needed is an opportunity for consumer preference to operate in order that the consumers may obtain the type of pork products they desire rather than be disgruntled.

It is of interest that lard yields per 100 pounds of live weight have remained largely unchanged over the past 10 years (14 pounds per hundredweight, or roughly 35 pounds of lard per animal). While hogs may be somewhat leaner than previously, pork cuts must be trimmed increasingly close. The extra trimming goes into lard. The consuming public is becoming increasingly concerned about obesity and the effect it has on reducing the life span. Associated with obesity is high blood cholesterol. Cholesterol is reported by a number of researchers to be a suspect for arteriosclerosis. Without drastic steps to confront the forthcoming resultant adverse publicity, we can see real dangers ahead for the livestock industry relative to hogs.

There is some question as to whether consumers have been getting the kind of beef that they want. A consumer survey carried on in St. Louis in 1953 indicated that the great majority of consumers are not familiar with Government grades and that even fewer know brand names. There is increasingly less basis to support the contention that the highest satisfaction goes with highest grades. I suspect that this is true for the great majority, at least for a very large segment of our population. Increasing preference for the highest grades resulted with trimming the surface fat down to one-fourth of an inch. The results of this study indicate the consumer was primarily concerned with tenderness and flavor. These characteristics are no means restricted to the highest grades.

There are a large number of developments taking place in the processing of meats. Perhaps of greatest interest, at least from a long-range point of view, is that of ionizing radiations. Major support in these investigations has come from the Atomic Energy Commission and the Quartermaster Food and Container Institute.

For clarification it should be pointed out that irradiations at a level which are extremely lethal to man have practically no effect on the microorganisms causing spoilage in meat, and are totally ineffective in inactivating the natural enzymes which cause decay. In general the less complex the biological organism, the more irradiation that is required to secure stability. Thus, very high levels would be required to inactivate the enzyme systems in meat. Somewhat less would be required to kill the spore forming bacteria. Even less would be required to give a surface sterilization, which in turn would extend the shelf life. Less irradiation yet would be required to kill parasites in meat such as "Trichinella Spiralis."

Let me also point out that one of the major difficulties associated with irradiation and especially high level irradiation is that of "off-flavor" production. Also there may be change in the color and texture. A considerable amount of work has already been done on preventing these changes by the use of additives, low temperatures, and varying vacuum conditions. I wish to emphasize that these problems are most severe at high levels of irradiation. These problems, together with those associated with the higher cost of the large capacity machines, suggest that commercially this application is likely to be limited in the more immediate future to parasite control and some measure of surface sterilization. It will thus complement already existing methods of preservation. The difficulties which will be encountered in developing complete sterilization

processing appear to be very great. With the interest and support being given this work, however, we may surmise that the solutions to these problems will be found in the years ahead.

Of more immediate interest is the matter of frozen meats. During recent years a considerable amount of technological innovation has taken place in retail meat distribution. Perhaps of most importance is that of self-service, which involves prepackaging. At present, fresh meats are prepacked almost entirely at the retail level, because of the serious technological problems of package drip, moisture condensation, and color changes. Prepackaging of fresh meats at the packinghouse level is presently considered not feasible, and no satisfactory solution appears imminent.

As a result of extensive and intensive investigations which have been carried on by both industry and the public-supported institutions, we have sufficient "know-how" for placing a first-class frozen product on the market. It is well to bear in mind, however, that many in our urban areas have consumed very little frozen meat. In the St. Louis study in 1953, when asked the question, "Do you ever buy frozen beef of any kind?", only 20 percent indicated that they had ever purchased frozen beef or fresh beef for freezing.

There are, however, a number of problems and unanswered questions. Involved is appearance of the frozen product—the matter of blind versus transparent packaging. We do not know how far we should go on fabrication of primal cuts. Also involved is the development of an increasing number of more or less fully manufactured items. One of the great selling points for frozen meats is the possibility for great savings in transportation and other costs. It should be appreciated that a marked increase in price must result if extensive fabrication is used in removing all bone and trimmable fat. Finally there is the matter of grade and weight. I am sorry that we do not have data on this matter as it relates to preferences for frozen meats.

How frozen meats are to be handled on the consumer level is a question with currently few answers. Historically, and particularly in the rural areas, locker plants have taken care of a major portion of the business. During the past 5 years frozen food plants have been developed to a considerable extent. Only recently however, have the potentialities of these plants become rather apparent. Still more recently we have noted that commercially frozen meats are being sold both in the large city supermarkets and in the small town stores.

Whether sales are made through the supermarkets, other retail outlets, food plants, or by locker plants, they will each count strongly on the nearly 8 million freezers which are in the homes of this nation. In many respects these home freezers are becoming a home supermarket for frozen foods. We believe that many homemakers prefer to have this variety of frozen food handily available. They are becoming quite attached to their freezers and find they offer real conveniences in food buying and meal planning. Many are having their frozen foods delivered. A sizable proportion finance quantity purchases. Meats are the number one item in these freezers, but approximately 90 percent also have frozen fruits and vegetables in them. Other items include ice cream, juice concentrates, baking products, poultry, fish, and prepared foods.

It is not at all out of the realm of possibility that with this frozen food pantry we may again return to home deliveries and deferred payments. This is possible through minimum order deliveries and finance plan purchasing. In this connection, L. B. Mann of the U. S. Department of Agriculture recently pointed out that in 1955 there was approximately 300 million cubic feet of net zero degree storage space for storing frozen foods in the United States. Approximately 40 percent, or 120 million cubic feet, is in the home freezers and locker plants of the country. This capacity is sufficient to store nearly 3-2/3 billion pounds of frozen foods. Seventy percent of this capacity is in the home freezers.

It could well be that a major evolution is about to be initiated in food purchasing. The opportunities for increased savings in time and reduction in drudgery are quite apparent at the home level. The opportunities for increased automation with resultant savings at the processing level are also apparent. The final outcome, while quite speculative, offers a host of most interesting possibilities. The developments of the near future, which include marked increases in the amount of self-service and display cases in the retail store, opportunities for quantity purchases at quantity prices, increased availability of low-temperature space in the home, coupled with high frequency dielectric heat for thawing and cooking in the home, all argue in a most effective way for the suggested changes in our way of living.

It is inconceivable that these changes at the home and retail level will not be paralleled by similar technological innovations at the processing level. At present we are seeing the development of continuous operation curing. Involved with the injection methods of curing is that of electrostatic smoking, thus making a continuous operation feasible. We are also seeing changes occurring in the location and designs of plants. On their way out are the large milti-story plants located in our big congested terminal areas. We can expect an ever-increasing decentralization of these plants directly into the heart of the producing areas. The new modern plants, with pleasant working conditions and surroundings and operating with great savings in time and improved efficiencies, point with ever-increasing clarity the road to greater savings and improved standards of living.

RECOMMENDATIONS OF WORK GROUP

Clifton B. Cox, Indiana, Chairman
C. P. McClaugherty, Virginia, Secretary
Raymond W. Hoecker, A.M.S., U.S.D.A., Consultant

In order to give consumers the kind of meat that they want, more work should be done on standardization. Beef as well as pork should be processed to suit the taste of the housewife, which calls for some grading and standardization of the product. Grading assistance should be provided through schools for buyers, schools for sellers, and schools for farmers on types and grades of animals being marketed.

New methods of curing hams and bacon are more efficient than the old, but the products are lower in quality. The new methods, however, undoubtedly will

continue to be used because of their efficiency. Younger people will accept these products, since they have not developed a taste for those cured under the older processes. However, if these new methods could be improved to produce higher quality products, the demand for the products would be greater.

The trend toward frozen meat has been slow. Many consumers never have bought frozen meats. These potential buyers could be reached perhaps by providing some time-payment plan for large purchases or perhaps by providing a more attractive frozen food package. The appearance of the frozen product is very important to the consumer. Some work should be done to determine what type of package is more effective--blind or transparent packaging.

EXPANSION OF MARKET OUTLETS

THE ROLE OF THE EXTENSION SERVICE IN EXPANDING MARKETS FOR AGRICULTURAL PRODUCTS

Raymond C. Scott,
Federal Extension Service, U.S.D.A.

The role of the Extension Service is that of an educational arm of the U. S. Department of Agriculture and off-campus arm of the Land-Grant Colleges and Universities. In marketing work, "The Extension Service has the authority and responsibility of developing and carrying on an educational and demonstrational program with growers, handlers, and consumers. Such programs include educational and demonstrational work in connection with assembling, grading, packing, packaging, processing, handling, storing, transportation, selling, pricing, merchandising, distribution, and consumer education. In marketing, the job of the Extension Service is to organize and conduct educational and demonstrational work. Extension programs provide information which helps individuals and groups to reason through marketing problems and make more intelligent decisions regarding action to be taken. They also help people learn by doing and encourage them to put into practice improvements in marketing that are economically sound." 6/

Some Considerations in the Expansion of Markets

The total per capita consumption of food is relatively constant from year to year. Most people in the United States eat all the food they desire. They are limited by the size of their stomach and ability to purchase different kinds of food, influenced by their likes and dislikes, and are continually bombarded by warnings from their doctors and insurance companies about the effects of overeating on their health.

While the total consumption of food is fairly constant from year to year, variation exists between different foods due to fluctuations in supply, price,

---

6/ As defined in the "Recommended Relationships Among State Agencies Conducting Marketing Programs Under Matching Provisions of Section 204(b) of Title II, Research & Marketing Act of 1946." ARS, USDA, March 18, 1949, Revised October 9, 1954.

and other factors. The extent to which we can shift from one food to another depends upon the substitutability of the food.

What contributions can we, as representatives of public agencies, make in expanding markets under such conditions?

With educational and other programs we can help to improve the nutritional levels of the people by encouraging a shift from low- to high-value foods, such as livestock products, which will expand the total market for agricultural products and require increased use of food producing resources. Through our programs with consumers and trade groups, we can encourage consumption of foods in abundant or plentiful supply. We may also help producers and marketing agencies size up foreign market potentials and encourage the production and marketing of products to best meet needs of those markets. By helping increase efficiency in performing marketing services or providing additional marketing services, we may improve the competitive position of specific commodities.

Types of Extension Programs Concerned with Market Expansion

There are 4 types of Extension programs which have as one of their objectives expanding markets: (1) Utilization, (2) commodity marketing, (3) food merchandising, and (4) marketing information for consumers. These programs are directed primarily at urban consumers, processors, and marketing agencies, although some work is done with producers.

Utilization. An educational program in the utilization of agricultural commodities was established last year in cooperation with the regional U.S.D.A. laboratories in Albany, Calif., Peoria, Ill., Philadelphia, Pa., and New Orleans, La. The program has as its objective acceleration of the adoption of research findings having to do with new uses of agricultural products and new and improved processing methods. This program deals with fruits and vegetables, grain and grain byproducts, mechanical processing of cotton, and dairy products.

To the extent that new developments in the laboratories expand the markets for specific commodities, this program fits into the overall discussion today. For example, educational work with the cotton textile manufacturers in the South and in the New England States involves improved techniques of manufacturing cotton products which should improve or help to maintain the competitive position of cotton products in the United States and world markets. Adoption of low-temperature lye prepeeling of potatoes, which is being stressed at the present time, provides hotels, restaurants, and other institutions with more desirable products and should also strengthen the competitive position of potatoes by providing a better product for the ultimate consumer.

These programs are conducted by specialists on the staff of the Federal Extension Service working with State Extension specialists and directly with processors or manufacturers.

Commodity marketing. A large proportion of Extension marketing work is done in connection with specific commodities. These programs involve work with

producers, processors, and handlers, and are aimed at maintaining quality, increasing efficiency of handling, adoption of improved services, and helping to achieve a better balance between production and consumption.

This work assists in expanding the market for specific agricultural products by improving their competitive position through either reduced costs or improvement of quality offered consumers. For example, intensive educational work has been conducted in the South on the adoption of equipment for precooling peaches immediately following harvest. This method has permitted harvesting fruit at a more advanced stage of maturity and has provided consumers with better quality fruit.

Food merchandising programs. Food merchandising programs are conducted by Extension Services in about 20 States and are aimed at improving merchandising methods in retail stores. Such programs have improved the competitive position of specific commodities or groups of commodities through improved merchandising practices.

Marketing information program for consumers. This program has expanded rapidly during recent years and is the one in which I thought you would have the greatest interest. This program is oriented to consumers and directed primarily at those living in urban areas. Agents or specialists use much national and regional data such as that developed through the plentiful foods program, market news, and the Crop Reporting Board. One of the important features of this program is that a great deal of attention is given to localizing information. For example, local sources of supply, such as wholesale establishments, chain-store organizations, market reporters, and others, are consulted prior to making a definite decision on types of items featured.

The objectives of this program are as follows:

1. To aid in the orderly marketing of agricultural commodities by:

   (a) Helping to move normal and abnormal supplies.
   (b) Encouraging the acceptance of new and improved marketing practices.
   (c) Reporting consumer wants and needs to producers and handlers.

2. To assist in the more effective use of agricultural products by:

   (a) Encouraging consumption of foods in season and in abundant supply.
   (b) Informing consumers of availability, relative cost, selection, care, value, and use of agricultural products.
   (c) Informing consumers about new products.

3. To help consumers get maximum satisfaction from their purchases of agricultural products by providing them with timely marketing facts and information on economic principles as a basis for decision-making.

4. To help consumers develop a better understanding of the marketing system, functions, and problems by providing them with information on

such subjects as production situation, economic trends, marketing costs, marketing margins, and changes in marketing system.

5. To motivate people to adopt improved buying practices.

Programs are currently operating in 62 cities located in 39 States, Hawaii, and Puerto Rico. A total of 83 full-time professional workers are employed, together with many part-time personnel who have commodity marketing assignments as their primary responsibility. In addition, many county staff workers located in metropolitan areas devote some time to the program.

Marketing information for consumers is issued as follows:

1. Weekly bulletins. These bulletins are prepared for professional people, such as newspaper editors, radio and television personnel, and others having programs aimed at consumers.

2. Institutional releases. These releases go directly to hospitals, homes for the aged, and other institutions. They provide information about commodities in abundant supply and contain information about selection, care, and use of commodities.

3. Specialized publications. Leaflets and releases are prepared for foreign groups, for summer camps, etc. These general publications are used as a basis for newspaper stories and radio and television programs, as well as for direct distribution.

Food marketing information assembled and analyzed locally is distributed as follows:

1. Newspapers. Information from all offices is used as a basis for newspaper stories or articles, weekly. About half the specialists and agents have their own weekly columns, and material from the remainder is used by food editors.

2. Radio. Practically all offices have radio programs varying from daily to biweekly.

3. Television. At the present time we have 30 television programs per week conducted by specialists and agents assigned to marketing information programs for consumers in the United States. The material is also used by other professional workers who have television programs.

The programs vary by States from that of one professional employee in a southwestern State to 13 professional workers in a heavily populated State. In the latter program, for example, personnel are located in 8 cities, have 290 minutes, or 4 hours and 50 minutes, of radio time per week, and 100 minutes of television time weekly. The material developed in these offices is used in 10 dailies and one-half of the 118 weekly papers in the State.

I suppose you are now asking yourself, what good does all this effort do or what is accomplished? We have some evidence of the type of coverage and accomplishments. For example, we have made a study of coverage of the material by radio, newspaper, and television in Louisville, Ky. We found that approximately 122,000 people in Louisville were receiving this information primarily through newspapers, 12,000 people were being reached regularly by radio, and 27,000 people were watching the television show. Regular contact through radio, newspaper, or television was made with 42 percent of the people in Louisville, or approximately 161,000. Nearly two-thirds of the homes, representing 231,000 people had been reached at one time or another.

Unquestionably, these and other programs beamed at consumers can have a marked influence on the demand for specific items. We have had many reports from producers and the trade indicating increased movement following these programs. For example, during the week of April 20, 1955, an intensive program was carried on in Tulsa, Okla. On April 20, a demonstration was presented on KVOO-TV on how to buy asparagus, with emphasis on freshness and quality of product. The following day a film was shown on harvesting, packaging, and transporting local asparagus, together with a cooking and serving demonstration on this station. The next day a program was presented on the proper method of freezing asparagus. During the same period radio broadcasts covering general points were presented over one of the local stations. Local retail outlets also featured asparagus in their newspaper advertisements at the time.

During the previous week, local producers reported that they were in full production but that the market in Tulsa was very limited and that supplies were piling up in their cooling rooms. During the week of this intensive program, asparagus sales increased in the store of one national chain organization operating in Tulsa 310 percent over the corresponding week the preceding year. Other retail outlets reported substantial increases in sales over the previous year. Spokesmen for both the growers and retail outlets indicated that the up-to-the-minute information on supply, quality, and price, together with other pertinent information, was very instrumental in improving the demand for asparagus.

In Michigan, for example, Mr. H. F. Koeplan, manager of the General Motors Technical School cafeteria said, "The information has been very beneficial. It has saved us money."

We could give you many other examples where local surpluses of foods have been moved rather rapidly following an intensive information program with consumers.

The most important long-run effect to the people should come from upgrading our diets. This, of course, would result in greater use of food-providing resources.

THE ROLE OF STATE DEPARTMENTS OF AGRICULTURE IN EXPANDING OUTLETS BY PUTTING INTO PRACTICE THE RESULTS OF RESEARCH

Research Work Done by the Maine Agricultural Experiment Station on Consumer Preferences for Potatoes

Alvah L. Perry,
Maine Agricultural Experiment Station,
University of Maine

We in agricultural research at the University of Maine, devote considerable attention to potatoes as you might surmise. Potatoes are our leading crop and, other than poultry, are our leading source of agricultural income. Although we believe we raise about the best potatoes in the Nation, many of us feel we do not do the merchandising job that is to the best advantage of our growers.

Last season about 90 percent of our tablestock potatoes were marketed under the minimum size requirement of the Marketing Agreement and carried the U.S. No. 1 label. We believe that a large percentage of the consumers want a better size and grade of potatoes than we have been giving them. We also believe that consumers will pay the price which will make it profitable to the grower and packer to supply the kinds and qualities of potatoes consumers want, packaged as they want them. One of our jobs in potato marketing research is to determine what the customers want in the way of potato quality and whether or not they will pay the cost of supplying those qualities. We feel that the best way to find out these things is to give the customer an actual opportunity to buy the quality of potatoes we feel will meet with his approval at retail stores.

We are very fortunate in having our own facilities to store, grade, and pack the different qualities of potatoes we are interested in testing. Having these facilities, we do not need to depend on commercial packers to do the grading and packing operation which might lead to many problems in obtaining quality control and the volumes of potatoes we need for an experiment.

We are very appreciative of the excellent cooperation we obtain from the chain and independent retail stores in permitting us to conduct these studies in their stores. Without their cooperation we would not be able to conduct any of these studies. Also, we are very appreciative of the cooperation and assistance that the Maine Department of Agriculture gives us in carrying out these studies. Before starting one of these experiments we always confer with Stan Painter and George Chick of that department to get their thoughts on the value of the study and how practical it might be to the industry. They always have been very interested in our work and always have provided us with one or more of their men to work directly on the study. Not only do they get firsthand information of what is going on, but by being closely associated with the actual studies, they have a different impression of the merit and practical application of the experiment from what they might have gained from looking over the cold statistics after the study was completed. We benefit at the same time by their counsel and

assistance in carrying out the projects. By working together, we believe our work will be of much greater value than if each agency went its separate way.

One of our first experiments on consumer preference for potatoes was done in 1948 by Dr. Charles Merchant, Head of the Department of Agricultural Economics. This study was aimed at determining the consumer preference for potatoes of different sizes. The study showed that more people preferred the medium size potatoes to any other, and that they preferred the small potatoes to the large ones.

In 1949 we started experiments on washing Maine potatoes. Potato washing was not new, as you know, but it was a new experience for Maine. At the time there was a great deal of opposition from the trade, and practically everyone to whom we talked believed washed Maine potatoes would deteriorate before reaching the market. To make certain that water left on the tubers would give us no trouble through the development of late blight rot, we used a heat dryer to make sure the potatoes would be perfectly dry at the time they were packaged. After a series of experiments in storing the washed and dried potatoes under controlled temperature and humidity condition we concluded that the washed potatoes would keep just as well as unwashed potatoes of the same initial quality. After two seasons of consumer acceptance tests with these washed and dried potatoes, further experiments led us to dispose of the expensive heat dryer and to dry the potatoes by a series of sponge rubber rolls.

We made consumer acceptance studies on washed potatoes in the 1949, 1950, and 1951 shipping seasons in the Maine and Boston and Worcester, Mass., markets. All these studies indicated that most consumers wanted clean potatoes and would pay the added cost of washing.

About this time the new plastic packaging materials were becoming available. We made a test on consumer acceptance of potatoes packed in polyethylene bags, and were quite surprised with the response. This study illustrated that customers wanted to see the quality of potatoes at the time they made their purchase. Although the polyethylene bags look flimsy and the potatoes will turn green after about 4 days on display at retail stores, the bags proved rugged enough for the job. With a little educational work with the retailer, greening was not a serious problem.

Dr. Charles Merchant conducted a series of experiments on the acceptance of potatoes separated for specific cooking purposes on the basis of specific gravity. This study indicated that most housewives in Maine wanted a baking quality potato, while a smaller proportion were looking for potatoes that would not break apart in boiling.

More recently we have been conducting experiments on the acceptance of different grades of potatoes. Last season we packed potatoes to the U. S. Fancy grade and found that a rather large percentage of the customers would pay very high premiums for potatoes of superior external quality. This year we are conducting a study to determine whether or not a grade of somewhat lower external quality is as acceptable to the customer as potatoes meeting the exacting standards of the U. S. Fancy grade.

We have found over the past 8 years that it takes more than an experiment by a research team to get the trade to put into practice the ideas that look

promising from research. We in research cannot do this promotion job. We do not have the authority to do this type of work even if we had the time, money, and personnel to carry it out. If our experiments appear to have promise for adaptation by the trade, someone must carry the load in taking the results of our experiments to the individuals who will put them into practice. Such has been the role of the Maine Department of Agriculture. Their success in doing this promotion and service work is partly illustrated by the fact that about 2½ million bushels of the Maine potato crop are washed and over 15 percent of these washed potatoes are packed in polyethylene bags.

How the Maine Department of Agriculture Puts Into Practice the Results of Potato Research

George H. Chick, Division of Markets,
Maine Department of Agriculture

You have listened to Dr. Perry's talk on the procedures of the Maine Agricultural Experiment Station and of its efforts to find out the consumer's preference for potatoes. I can assure you that the preceding speaker could have told you a great deal more had time permitted. I would like to say for the records that we in the Maine Department of Agriculture appreciate very much the fine cooperation we have always had from the Experiment Station.

For the next few minutes I will discuss the steps we took to take advantage of the results of research work that has been outlined to you.

The first 3 steps that were taken to get ready for a good service program were: (1) To establish some official grades that would include the sizes and quality of potatoes that the Experiment Station had found consumers desire. (2) To find packers who were willing to wash and put out a superior grade of potatoes. (We finally had 2 or 3 shippers who were willing to do so, and at the end of the first year we had 9 shippers washing potatoes in about 12 different locations. Getting the cooperation of shippers was accomplished not only through the efforts of our own Department, but also through the Station, Extension Service, and industry people who took an active interest in encouraging shippers to set up to do the job.) (3) To introduce the improved packages into retail stores so that consumers could purchase them.

Strange as it may seem, the third step appeared to be one of the hardest. I remember when the Experiment Station was carrying on a project in one of the New England markets, it demonstrated that consumers were willing to pay a substantial premium if they could purchase the desired product. After the project was terminated, it was next to impossible to get the store to continue with a similar pack even though consumers continued to ask for the product after the project was closed.

After these initial steps most of our work was centered on expanding the outlets for washed and graded potatoes, although some work on the establishment of additional washing and grading operations was continued. (Incidentally, the

number of shippers equipped to wash potatoes had increased to approximately 100 by January 1955.) In our attempt to expand the outlets for Maine potatoes, we have sent marketing specialists into most of the major eastern markets. These men contact wholesalers, chain warehouses, and in many cases retail stores, and supply the trade with sales material.

When these specialists are in the markets, they always call on the food editors of local papers, who are very cooperative in putting out material to aid in the sale of potatoes. These food editors appreciate the efforts of our marketing men and invariably will give us recognition in their food page.

As an example, I will quote a portion of a typical article which came out in the Detroit Free Press as a result of a call by one of our marketing specialists. The article covered approximately one-quarter of a page which, of course, was devoted mainly to the use of potatoes.

> "There has long been a rule that a 'State of Maine potato doesn't go to market just because it grew.' The development of a high quality potato has given it a pedigree that would make a proper Bostonian jealous.
>
> "And now they are coming to Detroit homemakers scrubbed clean, graded for size and packed in transparent sacks that show each spud, at attractive prices--a 10-pound sack for 43 cents. All measure between 2¼ and 3¼ inches and are U. S. Extra No. 1 in quality.
>
> "To help housewives find more ways of preparing potatoes they are making available the 'State of Maine Potato Cook Book,' a collection of about 50 recipes.
>
> "This trio of recipes will give you some new ideas with this old-time vegetable favorite."

This portion of the article was inserted at about the middle of the story, in heavy print for emphasis. This is only one of many similar stories we were able to help obtain for the potato industry. Also a lot of work has been done with radio and television stations, and our specialists have appeared on these programs many times. The stations are very cooperative in giving us an opportunity to tell our story to consumers and other interested listeners. Two or 3 short films developed for use on television have had a very wide use.

We have tried to introduce washed potatoes through many special programs. For instance, at the opening of a large filling station in the Portland area, one of our specialists who had noted that gifts customarily were given away on opening day sold the station on the idea of giving away a 10-pound bag of washed "Maine Medium Potatoes." Needless to say, this idea was an excellent boost to the use of these potatoes in the Portland area.

Another method of helping to expand our market is through consumer displays at such places as the Eastern States Exposition in Springfield, Mass., and at national trade association meetings, such as the United Fresh Fruit and Vegetable

Association, restaurant associations, potato chip associations, and other conventions held by the food trade.

Another important phase is to report to the industry on what you are doing and keep them informed. An exhibit was set up in Fort Fairfield, Maine, last winter at the time Secretary Benson was in Maine. This exhibit was visited by hundreds of growers and shippers.

I would like to call your attention to the Potato Councillor, the official publication of the Potato Industry Council of Maine, which is sent out monthly to over 5,000 Maine potato growers and shippers. Our marketing specialists report monthly to the industry through articles in the Councillor, and the Councillor has on many occasions run pictures of exhibits on other phases of our marketing work.

Before closing, I would like to point out that the Maine Potato Committee publishes a paper called "Potato Topics." This paper is extremely helpful in our work, as it is sent to all of the food editors and is devoted mainly to the use of potatoes. These editors use the material, and on a number of occasions the News Service has selected items out of "Potato Topics" and sent them to women editors all over the country.

In conclusion, I think it is extremely important to try to find out from consumers how our product is being received. To touch briefly on this point I thought I would take advantage of the progressive idea of one of our shippers. He printed on his polyethylene bag the following legend, addressed to Mrs. Housewife.

"Potatoes will turn green in light. For best results store in dark, cool place. Your comments on our potatoes will be appreciated. A. L. Thompson & Sons, Box 35, Limestone, Maine."

Mr. Thompson had hundreds of letters in response to this request, and a few of the typical replies are quoted below.

"As a discriminating housewife and mother I always shop for the best in foods for my family. Lately, my purchase of potatoes has been like a nightmare. You reach into a dark bag and bring out potatoes caked with earth, half rotten, half of them to be cut away not eatable. What a pleasant experience to buy your potatoes in the Portsmouth, N. H., First National today. Another thing I find so nice is that my potatoes for baking are all the same size. No bringing forth from the dark bag potatoes of enormous sizes and then be left with ones so small it would seem a shame to even peel them. I do want to thank you for giving me the opportunity once again to make a potato purchase of quality."

"Had some of your Thom' Sons' potatoes recently and I must say they are the finest I've tasted in a long time. I was getting tired of having so much waste to the potatoes I had been using before. They seem to cook all apart. Then one day in our local Acme Market, I saw your potatoes. They looked so clean and all so nicely sized, I purchased a bag of them and have been using them ever since.

Regardless of how I prepare them, they are always delicious. In fact, I've never had so many potatoes cooked in their jackets or baked as I have had recently. But I find them perfect for either because they are so clean and all about the same size. I'm glad that I have finally found a good grade of potato. I have told my friends about them so keep up the good work. Best of luck."

"I have purchased 2 bags of your potatoes and I want you to know that I think they are the best potatoes I have ever purchased. They taste good and are so nice and clean, sized, and solid. They are not all eyes and cracks and filled with dirt like the other potatoes on the market. All other brands of potatoes are so dirty you practically have to take a bath when you get finished peeling them and the sink is a mass of mud. But your potatoes are a pleasure to prepare for dinner. Well, I visited my store and couldn't find your brand of potatoes anywhere. I asked the man in charge of produce where they were. He said they don't get them in very often but when they do get them, they sell out very fast—so I ended up with the usual dirty, cracked potatoes and believe me I'm not too pleased. Can't you folks do something about this? I have heard other women complain about the miserable potatoes and I know if your product is made available to us we will buy it."

"It is a pleasure to take time out of a busy day to comment on your potatoes. The reason, first of all, why I was attracted to them was the cellulose bag whereby I could see what I was getting and, secondly, their cleanliness and, thirdly, their evenness in size. And thanks for the tip on why green appears on potatoes, something I didn't know. This is the first time I've ever taken the time to tell a producer of his product, but we enjoyed them so very much, well, keep up the good work."

"We feel after using a sack of your attractively bagged potatoes that you can point with pride to the results of your effort. They were the best we have seen and they represent the type of marketing we feel Maine potatoes deserve."

"You request comments re your potatoes. Let us face it—you fellows just shouldn't be in the business. The only accomplishment you tend to achieve is to make millions of discontented housewives across the country. Sure! We're 'Queen for a Week' when we're preparing your clean, select potatoes, but what happens when our 10-lb. bag runs out and we have to resort back to those half-sick spuds we've been using all winter? Seriously, I would like to commend you most highly on your product and the manner in which it is presented to the public. I've had dirty, half-rotten potatoes for so long that I finally became resigned to the fact and accepted them as a matter of course. Imagine my delight last marketing day when I was fortunate to get some truly fine potatoes. They merit comment. I'm from the old school who firmly believes that a meal just isn't there without potatoes, consequently, my poor husband has had to put up with hearing me rave about my 'find' every day for the past week. Gee, it's great not to have to cut away half the potato before you can get a decent piece to toss in the pan. Enclosed please find an article which appeared in our local paper the other night. Similar to the article, in my case, I first chose your brand because I could carefully scrutinize each potato. After they had attracted my eye appeal, just 3 little words cinched the sale for you—Packed with Pride.

It made me feel that somewhere along the line before the potatoes got to me, someone had really taken an interest and gave the potatoes careful individual attention. Cheers to you and your organization. May you continue to produce such fine potatoes for we hungry consumers."

"Congratulations on your attractive merchandise--it is the first time the Maine potato has been marketed to give the buyer a clean, pleasure to use, product. For years housewives have been emptying a cup of top soil out of their potato pin weekly--along with 2 or 3 bruised or rotted ones per pk. (Hidding in the old brown bags.) What a job to find 6 the same size to bake--and what to do with that one giant that filled two-thirds of the bag. Your packaging takes care of all these little problems and I for one thank you."

THE ROLE OF THE FOOD DISTRIBUTION DIVISION, A.M.S., U.S.D.A., IN EXPANDING OUTLETS: HOW THE PLENTIFUL FOODS PROGRAM WORKS TO EXPAND MARKETS

G. Chester Freeman, Food Trades Branch,
Food Distribution Division,
Agricultural Marketing Service, U.S.D.A.

When Bill Crow asked that I talk to you in this National Marketing Services Workshop about the Plentiful Foods Program, I had some doubts about the wisdom of accepting. I was afraid that it might be an old story to some of you who have heard my story about plentiful foods at previous workshops and perhaps on many other occasions. And I was concerned about wearing out my welcome.

But Bill had a couple of suggestions that he thought might give the talk a new meaning to you. One was that I spare the talk and show you how the program works. And the other was that, recognizing the active interest that many of you have in plentiful foods, I direct my remarks toward how our efforts and your efforts can best be coordinated to do us both the most good.

Both seemed to me to be excellent suggestions and I accepted his invitation. The Plentiful Foods Program of the U. S. Department of Agriculture is designed to expand the market for foods which are in plentiful supply by increasing their movement to consumers through the normal channels of trade.

The workhorse of the program is the monthly Plentiful Foods List. Most of you, I imagine, are familiar with this list. Now, it's not good story-telling to start off with this published version of the list, because a whole lot of work has already been done by the time we reach this stage. We are greatly concerned about the integrity of our list. We have to maintain its reputation, if we are to continue to receive the excellent support that we are getting from all segments of the food trades and from all the food editors of all the various media.

We are, therefore, very careful in determining the items which go on the list. We use the full facilities of the Department in making our selections--all

the information gathered by its crop reporters, and market reporters, and commodity specialists. We make a thorough canvass of the food trades, too, and we enlist the help of the State Departments of Agriculture and Extension Services in determining what items to list.

All of the Department agencies which are concerned with our food supply are represented at the Review Committee meeting that determines the monthly list. Out of that meeting comes this list--the monthly list of Plentiful Foods. Now, this is the national list--the story for the country as a whole. And it goes only to national organizations and others in the food trades who are concerned with the countrywide situation.

Each of our 5 area offices adapts this national list to the situation in its own area, dropping some items occasionally and adding others more often, to tailor this list to fit the supply situation for that area. Then these lists are mailed--well in advance of the month to which they apply--from these area offices to all segments of the food trades. Each and every month some 40,000 of them go out, carrying the story widely to the food industry.

Now, I would like to call your attention to 3 points about this list that fit it particularly well into the business of food merchandising.

One of these is the monthly features. Each month 1 or 2, sometimes 3, of the listed items are designated as features. They are items which are expected to be in especially plentiful supply, and they are given feature treatment to help the food trades to give them special support.

Another point is the listing of extra emphasis items, week by week. The food trades, of course, have a tradition of merchandising weeks. The nature of the food business, with its pile-up of weekend buying, leads merchandisers to put extra emphasis on certain items each weekend. That is the object of our extra emphasis items--to help the food trades give extra help to an item in a particular week. Our informational emphasis is tied into that same schedule. The combination of concentration on the item in the newspapers and on radio and television, plus food-trades pushing, gives the item real help. We schedule each of the features for extra emphasis for at least 1 week each month, and we tie the extra emphasis schedule into special drives in which we are cooperating with the industry.

That leads us to another point about the list--the merchandising opportunities. As promotion of foods becomes more and more important in the field of agricultural marketing, more and more organizations are staging special promotions of one kind or another. When these serve to move plentiful foods, of course, they serve the same purpose as the list itself, and we use the list to support them. Those campaigns which have the sanction of the Department are given a display treatment in our Merchandising Opportunities box, and the details of the promotion are usually included in the text of the list.

Whatever success the Plentiful Foods Program has enjoyed is due almost wholly to the excellent support it has received from the food trades and from

the Nation's food editors. We could not begin to do an adequate job of showing you all the support that the trade and the press give us. But I do want to show you some typical samples of that support, and I want to emphasize that these are only samples. There are many, many more people all through the food trades who support the program, but we simply do not have time or space to list them all.

The National Restaurant Association backs up the program in its Food Outlook, going monthly to some 64,000 members. The Super Market Institute backs us up through the S-M-I Carrier, in which they have picked up our Merchandising Man. Incidentally, many publications use some of our art work developed in support of the list in carrying the story, and we are glad to have them do so.

The Cooperative Food Distributors of America gives the list a play in its Cooperative Merchandiser magazine. Inplant Food Management magazine for industrial feeders carries an inplant food report each month. Institutions Magazine for the food service industry carries a story of Plentiful Foods in its monthly newsletter. Two other strong merchandising efforts that get behind the list each month are: The Bellringer, the Ladies Home Journal merchandising service that goes to more than 2,000 wholesale and retail operators representing nearly 400,000 stores; and McCall's Magazines' pocket book, that goes monthly to the top men in some 2,000 food-buying organizations.

In addition to the regular monthly plentiful foods activity, special campaigns are undertaken when foods face particularly difficult marketing problems. These special programs are an intensification of the regular programs, and are scheduled for the period of the commodity's peak supply. They are conducted only upon the request of the producers of the foods and in cooperation with the industry's own promotional efforts. A lot of discussion and conferring go into the decision to launch a special campaign, and when that decision has been made, we start the ball rolling with a fact sheet. Some 70,000 copies are distributed to all segments of the food trades throughout the country.

A letter from the Secretary is another early step. This letter is sent to executives of national organizations in the industry, telling them the story and asking their support of the campaign. Another early step is advance notification to food editors, especially of magazines which, because of their nature, must have long advance notification if they are to be able to cooperate. That early start really pays off. A few samples to prove the point are some of the spreads that resulted from our long advance on the rice campaign. Sunrise, the Farm Journal, Sunset, and the Texas Food Merchant used several Department pictures on their covers.

Our food tradesmen get an early start, too, in contacting the trade, intensifying their regular contact work in behalf of the special program. They work with everyone in the food trades--wholesalers, brokers, retailers, public feeders, institutions, trade associations, and many more. Those food tradesmen work out of our national headquarters in Washington, and out of our 5 area offices. In addition, they have been stationed in 5 subarea offices. During the past year, 6 more of those subarea offices were opened to do a better job of locating our men in position to gain maximum support.

Some examples (again, they are only examples of many more) in the retail field of the support given us follow.

Copies of a letter that Secretary Benson wrote to the National Association of Food Chains and a copy of our fact sheet on pork were enclosed with the bulletin that the Association issues to its members. I-G-A headquarters, following our contact, asked all their stores to feature pork in their advertising and gave them an impressive suggested ad to help them get behind the drive. These suggestions from their headquarters, the stories in the trade press, and our contacts with retailers, all add up to impressive merchandising backing for these special campaigns.

Many displays were set up in retail stores in support of the rice program. Another example of another part of the food trade tieing into a special promotion is variety stores. One of them reproduced our fact sheet and sent it to member stores, and many more featured displays backing up the special campaign.

You may not think of school lunchrooms as being part of the food trades, but they are an important part. Nearly 7 percent of the meals eaten away from home are eaten in school lunchrooms. Last year, 11 million children ate lunch at school every school day under the National School Lunch Program. Their meals at school add up to the stupendous total of 1,800,000,000 meals, representing a market for nearly 2-1/2 billion pounds of food.

In addition to that National School Lunch Program, our Division administers the Special School Milk Program. Through this program 450 million half-pints of milk were distributed this past year. This year the program already is running 41 percent ahead of last year in the number of schools taking part.

But to get back to school lunches, one way we bring them in regularly to the Plentiful Foods Program is through our monthly listing of School Lunch Specials. These Specials are suggested to the State educational agencies, which pass them along to the schools. With these schools buying nearly 250 million dollars worth of food every year, those specials swing a lot of buying power to the plentiful foods.

One way that we are making an extra effort to use more plentiful foods in school lunches is, as part of our service to schools, to provide them with a card file of recipes for use in preparing the lunches. That file already has recipes for using potatoes in more than 30 ways. We reasoned that the more ways cooks know how to use potatoes, the more they will use. Consequently, two more recipes were developed. An attractive folder was set up and sent along with the recipes, through the State educational agencies, to all the 59,000 schools that take part in the school lunch program.

One of the most gratifying developments in this plentiful foods campaign has been the way that the food industry and its advertising experts have swung into support of these foods through tie-ins with their own products. There was a lot of it in the campaign on rice and a lot more of it in the current campaign on pork.

These examples give you some idea of the fine support that the Plentiful Foods Program is getting from the food trades. It gets fine support, too, from food editors for newspapers and magazines, women's directors of radio and television stations, the trade papers, the syndicates, the advertising agencies, and many more people who are able to influence consumer buying. To obtain this support, of course, it is necessary to inform the food editors on the plentiful foods situation and to give them the materials with which to work. For this purpose we have built a strong program of information support for the Plentiful Foods Program. Our Information Division provides a continuing flow of stories on the plentiful foods list, tailored to the needs of such users as food editors, the trade press, and magazine and snydicate writers. Then, each of the area offices puts out one of these packages of food news every week, rounding up the news of the plentifuls--supplies, selection, and use. More than 2,000 of these packages go out each week to food editors who have requested them.

For special campaigns this information program, too, is stepped up. The Secretary issues a press release announcing the campaign and urging support. A fact sheet for writers is prepared and sent to some 9,000 editors. Special press releases are written. And through weekly news packages we conduct an accelerating campaign, aimed to peak at the time of the drive.

Special scripts are prepared for radio use. Spot announcements are written for use at station breaks and for inclusion in women's programs.

Full use is made of the newest and most potent medium, television, with special programs arranged. And a Television Package is built and supplied to stations, with a series of pictures and an accompanying script focusing attention on the plentifuls.

In addition, pictures of the plentifuls in use in food dishes are provided to editors for food page use, either in the form of pictures or as mats. Department recipe booklets suggesting additional ways to use the plentiful items are distributed. Also, the Department's publications are used to carry the story of the plentifuls to the many persons they reach.

Strong support is given to the Plentiful Foods Program through the Federal-State Extension Service. This Service gives continuing support to the plentifuls through their regular press releases and through the articles and activities of its home demonstration agents. The rapidly expanding consumer information program has been especially helpful in carrying the word about plentifuls to an ever-growing audience.

The discussion thus far takes care of the first part of my talk--the part on how the program works. And it leads us into the next part on how we can work together to make the Plentiful Foods Program even more valuable as a marketing mechanism. The possibilities fall into 2 fields: (1) Preparation, and (2) implementation.

You know--and we know--how much help you can be to us in preparing the list. You have been working with us long and well on this phase of the program, and we want to take this occasion to thank you for your excellent help.

We know it is clear to you how important that information is in the present situation, when so many farm products are being produced generously. The large number of eligible candidates for the list makes it more important than ever that we have a clear, comprehensive picture of the supply situation as a basis for making our decisions. We want you to recognize the heavy responsibility that we place on you when we ask you for that information.

Agriculture's position is such that the Plentiful Foods Program is a vital force in dealing with its problems. Therefore, we cannot afford to list any item that is not validly plentiful. One reason is that there are too many items every month that are validly plentiful. Another is that, to keep the acceptance of the list at its present high level, we must guard against any listings that are false, or questionable, or purely "favorite-sons." That kind of information will not help us any. In the long run, it will not help either you or the farmers, whom you are doing your best to serve. We know you appreciate that problem and its potential dangers, and that you will help us to guard the integrity of the list.

There is a wealth of opportunity, and possibilities for us to work together in the Plentiful Foods Program. But the main point is that the plentiful foods work has a good start on a firm foundation. There are many ways in which it can be improved--many in which you can help. Helping us to improve the program is the way you can most effectively direct the energies, the personnel, and the funds that you are able to provide for work along this line. By getting behind this program which is well-established, well-recognized, and of proven value, you will be best able to use your facilities efficiently and effectively for the greatest good of all concerned.

ORGANIZING THE RESOURCES OF PUBLIC AGENCIES AND INDUSTRIES TO MOVE COMMODITIES IN PLENTIFUL SUPPLY

Raymond B. Wilson,
Agricultural Economics Department,
Purdue University

If you are eating pork during your visit to Indiana, you are helping to dispose of the large supply of pork that is available. You also are cooperating in one of the activities of a new statewide marketing committee formed to help meet the challenge of more orderly marketing of Indiana farm food products.

Existence of this committee--the Indiana Farmer-Retailer Committee--is one example of the expansion of Purdue's already active program in agricultural marketing. This committee is guiding a new marketing project and is composed of representatives of food production industries, marketing agencies, and Purdue staff members. Such organizations as the Indiana Farm Bureau, the Indiana Retail Grocers and Meat Dealers Association, the Indiana Chain Store Council, and the Indiana Restaurant Association are represented on the committee. The objectives of this program are to:

1. Encourage production and marketing of commodities that are more acceptable to the trade and to consumers.

2. Provide better marketing information to the trade and to consumers.

3. Assist in moving plentiful commodities through trade channels by coordinated statewide effort. It is this phase of the Farmer-Retailer Committee program which will be discussed today as one example of organizing the resources of public agencies and industry to move commodities in plentiful supply.

The Pork Time campaign, October 13-31, is an example of a period set aside by the Farmer-Retailer Committee during which the use of a plentiful commodity was encouraged. The Hoosier Fried Chicken Fiesta, May 11-31, 1955, is another example.

In the case of pork, farrowings indicated large supplies of hogs would be available this fall. At the request of the Indiana Swine Breeders Association, a coordinated program was undertaken by the Indiana Farmer-Retailer Committee in cooperation with Purdue, producers, retailers, consumer specialists, and others. Purdue specialists in agricultural economics, animal husbandry, and home economics prepared radio tapes and news articles dealing with the availability, nutrition, selection, care, and use of pork. Articles prepared by the specialists were distributed through the Purdue Information Service to 87 daily and 200 weekly newspapers. Tapes were distributed to 27 radio stations. A television picture book and script were sent to 12 television stations.

Grocers throughout Indiana were informed by letter of the supply situation and encouraged to stress the sale of pork. Many grocers advertised pork extensively. Restaurants were also informed. Key newspaper, radio, and television editors and program directors were informed of the situation and their cooperation was obtained.

The Indiana Farm Bureau printed and distributed 7,000 copies of a leaflet explaining the pork supply situation. This was distributed to news and editorial writers, radio and television commentators, and others. The Indiana Restaurant Association alerted members, and the packer representative on the Farmer-Retailer Committee informed their customers of the availability of pork.

Types of information required to help determine well in advance which products are likely to require assistance.

The Agricultural Economics Department of Purdue University is active in the area of agricultural outlook. Each fall members of the Department prepare the agricultural outlook for the following year. This information is valuable in determining the general situation and in indicating commodities that may be in plentiful supply. As the season progresses, economists in the Department keep abreast of the supply situation using information from the U. S. Department of Agriculture and other sources. Information required varies, of course, with commodities. It was apparent months ago that hogs would be in plentiful supply

this fall and winter. Farrowing last spring was 9 percent above the previous spring, and we know it takes 6 to 8 months before the pigs come to market. The pattern of farrowings and the time it takes to get pigs to market weight enable us to determine, within limits, when pork will be most plentiful.

We know it takes from 9 to 10 weeks for broilers to reach market. Fairly good broiler-chick placement figures are available. The broiler supply, therefore, can be estimated with some degree of accuracy.

The Crop and Livestock Reporting Service makes periodic estimates of crops as they develop, and these are helpful in determining the expected supply situation. The Plentiful Foods Program of the U. S. Department of Agriculture, universities, and other sources provide additional information. Close contact with the trade is also very helpful in appraising the situation. Chainstore buyers are excellent sources of information.

Liaison to be established with agricultural and food editors.

Liaison with agricultural editors is well established through the Purdue Information Service which has been supplying them with information for many years. Agricultural editors have been informed of the Farmer-Retailer Committee through a series of dinners held for them, for food editors, and for radio and television program directors. News stories concerning the Farmer-Retailer Committee also have been sent to them.

Liaison with food editors and radio and television program directors is not as well established as it should be. These are key people in distribution of consumer information concerning commodities in plentiful supply because they reach consumers through mass media and have large followings.

Food editors and radio and television program directors attended dinners sponsored by the Farmer-Retailer Committee and arranged through county extension agents. At these dinners the informational people were informed of the Farmer-Retailer Committee and its activities. From people attending these dinners a list of informational people has been compiled. Those on this list are supplied with information concerning commodities in plentiful supply. The Purdue Information Service also sends these people radio tapes, news articles, and television picture books and scripts prepared by Purdue specialists in various departments. In addition, the list receives direct mailings from the Farmer-Retailer Committee.

Close liaison also is maintained with consumer education agents located in Fort Wayne and Indianapolis. The Consumer Education Program in Indiana is being expanded and agents will be placed in major cities as qualified personnel becomes available. These specialists are trained home economists who inform homemakers through mass media of availability, selection, preparation, care, and use of different food commodities.

Relationships with wholesalers, retailers, hotels, restaurants, and other food distributors and their organizations to obtain their cooperation.

Cooperation of several of these groups is obtained through the Farmer-Retailer Committee which has as members a fruit and vegetable wholesaler, the secretary of the Independent Grocers and Retail Meat Dealers Association, the vice-president of the Indiana Restaurant Association, the sales manager of one large chain, and the branch manager of another.

Direct mailings are made to independent grocers, chains, and restaurants. These mailings are made by the Farmer-Retailer Committee using the facilities of Purdue University. The executive secretary of the Farmer-Retailer Committee is a staff member of the Purdue Agricultural Economics Department. He coordinates the activities of Purdue staff members, Farmer-Retailer Committee members, and others. Because of limited personnel and funds, relationships are established with group representatives rather than with individuals. Wherever possible, the group representatives inform their members of the situation. For example, the vice president of the Restaurant Association, informed his members of the pork supply situation.

Informational and promotional materials to be provided wholesalers and retailers for their use during special promotional campaigns.

Material supplied to retailers and wholesalers in Indiana has consisted largely of informational material dealing with availability, nutrition, selection, preparation, care, and use of the commodity concerned.

No promotional funds are available. Indiana has no State Department of Agriculture. Since information is distributed primarily through Purdue University, an educational institution, use of promotional material is limited. This situation differs from that in such States as Maine and Wisconsin where promotion of agricultural commodities is done by representatives of their Departments of Agriculture. No point-of-sale work has been done. However, 10,000 copies of a National Livestock and Meat Board leaflet on pork were distributed by the Farm Bureau and the Swine Breeders Association. A movie relative to pork was used several times.

Coordination with the Plentiful Foods Program of the U. S. Department of Agriculture.

Contact is maintained with the U. S. Department of Agriculture plentiful foods people and activities are coordinated wherever possible. Mr. Beyers and Mr. Patterson of the Chicago plentiful foods office have been very helpful with suggestions concerning the Indiana program.

Determination of results.

Documenting results of a program such as the pork campaign on either a State or national level is almost a practical impossibility. The extent of activity may or may not be an indication that coordinated promotional efforts are effective in helping to move plentiful commodities through trade channels.

Industry people generally feel such efforts have appreciable effect. For example, hog producers and industry representatives meeting in Washington recently said that efforts stemming from the National Pork Promotion Conference have been extremely helpful in moving this fall's large pork supplies.

Consumers need to be informed about availability, nutritional values, and uses of different products. A coordinated program such as the pork campaign can be helpful and a part of the educational effort to make a more informed and rational consumer. An effective competitive marketing system cannot be built on the ignorance of consumers. There is an obligation to give consumers information upon which to base their decisions.

A coordinated program is believed to aid in moving commodities which in the very short run are in large supply. These products are usually perishable and must be moved into consumption or spoil. A special campaign can call the attention of the trade and consumers to the special supply and price situation. Such an effort may increase the demand for these commodities temporarily.

RECOMMENDATIONS OF WORK GROUP

John E. Mahoney, Maryland, Chairman
Kenneth R. Slamp, Pennsylvania, Secretary
G. Chester Freeman, A.M.S., U.S.D.A., Consultant

The benefits of an effective program to move commodities in abundant supply appeared self-evident to the work group.

The excellent program being carried on in Indiana was reviewed for the group. In Indiana, stimulated by an efficient secretary who is a member of the State marketing service staff and under the direction of a Farmer-Retailer Committee, most of the available resources in the State have been coordinated and brought to bear on the problem. The committee is composed of farm organization members, representatives of food production industries and marketing agencies, and Purdue staff members. The committee determines which commodities require assistance and arranges for preparation and distribution of informational material. Information is prepared for the committee by specialists in agricultural economics and home economics and by commodity specialists. Press information is distributed to 87 daily newspapers and 200 weekly newspapers. Twenty-seven radio stations receive tapes. Twelve television stations receive pertinent information. Retailers' and mass feeders' support is enlisted through direct mailing. Liaison is maintained with agricultural editors, food editors, radio and television program directors, Extension Service consumer education agents, and the USDA Plentiful Foods Program.

The discussion developed that all participants in the group, to a greater or lesser degree, are engaged in or contemplating a program to move commodities in abundant supply. The advantages of such a program have been recognized by many of our public and private agencies. The group agreed on the objectives but recognized that there necessarily must be some differences of approach

depending on local conditions. It was felt that marketing service agencies should take the leadership in areas where there is no program to move commodities in plentiful supply. If there is such a program, marketing service staffs offer valuable contributions to supplement the existing program.

There was general agreement that an overall program should be developed under the guidance of an advisory committee. The committee should prove invaluable in determining policy and, if representative, should prove a valuable tool to enlist support and cooperation. Experience of others dictates that selection of a commodity to be assisted should be decided by need alone, and that the integrity of the program must be protected with determined purpose.

Committee membership should be selected carefully. Broad representation is desirable, although too large a group should be avoided. Farm organizations, wholesale and retail food distributors, restauranteurs, industrial feeders, public utilities, land-grant colleges, and civic clubs can be the source of members to serve on the committee. The marketing service staff should furnish the committee the information required in order for it to determine commodities that should be given assistance. Various USDA reports, Extension Service specialists, and Land-Grant Colleges are valuable sources of factual data relating to supply, quality, peak movement, and price of commodities. This information should be kept current for all commodities likely to be in need of assistance.

When it is decided that informational and promotional materials are desirable, the State marketing staff should enlist the necessary cooperation to have the materials produced and assume the responsibility for their distribution. Informational material that has proved effective includes pamphlets on nutritive value, selection, care, and use of commodities. This material is usually readily adaptable for newspaper and radio use. More thought and development may be required for television. Much of the basic material can be secured from the marketing service agencies' files, the U. S. Department of Agriculture, Extension Service, trade associations, etc. Point-of-sale promotions and advertising tie-ins may be encouraged.

To secure maximum and timely cooperation, personal liaison should be established and maintained with radio, television, and newspaper personnel, food trades, and food service groups.

The activities of the State and local program should be coordinated wherever possible with the Plentiful Foods Program of the U. S. Department of Agriculture by: (1) Furnishing that Department with current information on local supplies, and (2) helping to implement the activities on special merchandising activities being conducted.

The work group recommends that the marketing service agencies give serious thought to developing a program to help move commodities in abundant supply. The value of such a program is pointed up in the fact that a program to move pork that could induce everyone in the country to eat an extra serving of pork would move almost as much pork as will the entire Department of Agriculture's purchase price-support program.

IMPROVED DISSEMINATION OF MARKET INFORMATION 7/

RECOMMENDATIONS OF WORK GROUP

Roy Bodin, Minnesota, Chairman
George Aull, South Carolina, Secretary
Stanley Andrews, Michigan, Consultant

Following a very fine report by Mr. Wessells on some work being done in Virginia, the group devoted considerable time to a discussion of need for more and better market information and for a courageous effort on the part of various market news services to give people what they want and expect in the way of market information.

It was agreed that there is need for more interpretation of data, with more emphasis on "outlook" and perhaps less on "history."

It was also agreed that many services in agriculture are missing a wonderful opportunity by failing to report their work in an interesting and appealing fashion. A statement was made to the effect that agricultural market data provides one of the best but least exploited opportunities of all types of information destined for dissemination. The group feels that agriculture--and in particular agricultural market news services--should make an intelligent bid for its share of the public service allocations available on radio and television stations and in the public press.

Some of the weaknesses in the present programs were brought out at the morning session by Mr. Stanley Andrews, consultant to this work committee. These include:

1. Ill-prepared information.
2. Poor presentation.
3. Failure to "localize."
4. Tendency to emphasize past history rather than current trends.

Mr. Wessells called attention to the excellent public response in Virginia to his Department's attempts to provide, on a weekly basis, a Farm Price Outlook. This report represents the consensus of individuals from organizations and agencies called together for the purpose but issued in the name of the State Commissioner of Agriculture. The report is careful, at the same time, to warn farmers against any panic action based on the information provided.

In the discussion following, it was repeated that some "pace setters" are helpful and are required in obtaining wide acceptance of any information or of any changes suggested.

7/ The speech by John H. Wessells on this subject was not transmitted for the proceedings.

Some question was raised as to how to overcome claims as to lack of space, time, etc., raised by available outlets for market news. It was felt that we do have a job in convincing these outlets that what we have to report is worthwhile and that if it is really worthwhile (and in desired form, style, etc.) our "consumers" will be prepared to do the convincing for us.

A number of specific suggestions were made for maintaining media interest:

1. Make the material good.
2. Present it in an interesting manner--with lift and clarity.
3. See that it is current.
4. Get it out regularly at a time of day that will most likely assure an audience.
5. Relate it to the local situation where possible. (Use names, places, dates, etc.)
6. Make the audience feel that it has a part and a responsibility in putting the program across.
7. When possible, visually illustrate your message.
8. Appeal to the curiosity of the reader or audience.
9. Keep the story simple.
10. Dramatize the story.
11. Do not undertake more than you can deliver.

While the group is conscious of our failure to take full advantage of current knowledge, it recognizes a need for continuing research and study designed to ascertain the most desirable means of communication from the standpoint of consumer response.

IMPROVING THE TRANSPORTATION OF FARM PRODUCTS

John C. Winter,
Transportation and Facilities Branch,
Marketing Research Division,
Agricultural Marketing Service,
U.S.D.A.

Before proceeding to the discussion of refrigerator cars and trucks and a number of other subjects that I want to mention, I would like to bring to your attention the talk I gave yesterday to the working group on reducing the cost of handling grain. (See p. 88.)

Perishable products such as fresh fruits and vegetables, meats, poultry, dairy products, and frozen foods are susceptible to damage by mechanical injury and by failure to protect them from heat and cold. Therefore, a substantial part of the Department's research on transportation has been concerned with finding ways to get these products to market with greater economy and less loss.

Actually, we do not know the full extent of in-transit losses of perishable products, because only part of them are reflected in the statistics on loss and

damage claims paid by the common carriers. We know, for example, that the annual claim bill of the railroads on agricultural commodities alone runs between 20 and 25 million dollars. Again, many of the losses are not detected in the delivery of the products that break down when they get to the wholesale house or the retail store, or spoil before the housewife gets to use them. My own guess is that if we were able to tie down all of these losses, the total would be not less than 100 million dollars annually.

Modern railroad refrigerator cars are a far cry from the first refrigerator car which was developed by a Chicago meat packer 100 years ago. Actually, that car was only a modified boxcar of the time, with an inch or so of some primitive insulating material, into which shelves had been built at each end of the car to hold cakes of ice. The ice was placed first, then the car was loaded with meat, which meant that once it was loaded, there was no way of getting it reiced. It would be interesting to know what temperatures went with that first refrigerator car.

Skipping the changes that have taken place during the intervening years, we come to the modern refrigerator car generally used for commodities such as fresh fruits and vegetables. It is equipped with air-circulating fans that drive the air up through the ice in the bunkers and out over the top of the load to filter back to the floor of the car, where the floor racks provide 5 to 7 inches of clearance for the movement of air.

Another type of car sometimes used for the transportation of frozen foods is the overhead bunker refrigerator car. This one is a little more efficient than the end bunker car so far as low temperatures are concerned, but still will not hold the zero degree temperature needed for frozen foods during warm weather.

As a general rule, the best temperatures you can get in the summer from an end-bunker car with ice and 30 percent salt are around 10° F. and in the overhead bunker car about 8° F.

The most recent development, the mechanical refrigerator car, has a compressor powered by a constantly running diesel engine. The compressor cycles on and off in response to the demand of an adjustable thermostat. This mechanism will hold temperatures at as much as 10° below zero for protection against heat. Also, by reverse cycling, it is capable of holding temperatures of as much as 70° F. in winter weather as cold as 35° to 40° below zero.

Much of our recent work has been done with motortrucks, which during the last 10 years have entered heavily into the transportation of perishable food products. A good deal of our work has been concentrated on the movement of frozen foods, since problems in this area are of major importance in food transportation.

A conventional trailer with a 5-ton refrigerating unit located in the nose of the vehicle has 6 inches of fiberglass or other high-grade insulating materials in the walls. We have found that 6 inches of insulation are necessary

and that means 6 full inches of uncompressed insulation. We have tested trailers with 6 inches of insulating material compressed to 4 inches to narrow the walls and provide a few more inches of interior space in the trailer, but the results are about the same as if you used 4 inches of uncompressed insulation. Six inches are necessary to hold zero temperatures.

When we started this work, we soon found that the temperatures obtained left much to be desired. The 5-ton unit was fully capable of delivering air at temperatures of zero or slightly less. However, our studies disclosed that the packages of frozen food in the top layers remained at or about zero temperature but that the temperatures of the commodity of the floor layer, particularly along the sides of the trailer, would be as high as 15° F. or 18° F. during the warm season. These trailers had grooved floors, either of wood or of aluminum, with the grooves running lengthwise of the trailer, about 1¼ inches wide and 1¼ inches deep. The operators hoped and expected these grooves would allow the cold air from the refrigerating unit to find its way underneath the load and give adequate protection to the bottom layers. The trouble was that they did not.

Obviously, the answer to this problem was to provide floor racks with enough clearance to permit the air to flow freely around and under the load and back to the return air duct of the refrigerating unit. However, the truck operator does not like to use racks because their weight subtracts from the payload he can carry.

Some trucks are equipped with wooden racks. Two of these floor racks will weigh from 600 to 800 pounds, depending upon the type of wood used and accumulated moisture from the washing and steam-cleaning of the trailer that is necessary, particularly when meat products are hauled. We have weighed wooden racks in trucks used for hauling meat that weighed as much as 1,200 pounds. Obviously, the operator is not at all anxious to cut his payload by that much. Incidentally, the operators of refrigerated equipment estimate that each pound of additional weight added to the trailer costs them at least $1 annually in the payload displaced so that the addition of 1,200 pounds of weight would cut the earning power of the trailer by $1,200 or more per year.

Aluminum floor racks have been used. These racks while doing a good job, were not entirely satisfactory because they were hard to remove when necessary and the cross slats were too far apart. Side wall strips were used to permit the movement of air down the sides of the trailer and protect that part of the cargo loaded against the side walls. We also experimented with a canvas duct suspended from the ceiling of the trailer. It was loose enough to permit some air to spill out the sides along its length and at the same time carry a substantial flow to the rear of the trailer for circulation back underneath the racks. We did not find this duct particularly useful in connection with loads of packaged frozen foods or meats. It was of value in loads of hanging beef where the cross rails interfered with the distribution of air coming from the evaporator unit. Fastened above the rails, it carried a sufficient amount of air to the rear of the trailer to refrigerate adequately the meat at that end.

Our engineers have since improved the aluminum floor rack, placing the cross pieces somewhat closer together for better carrying of the packages in the load and dividing the unit crosswise so that the two parts may be hinged, one against each side of the trailer. So hinged, they may be pushed up against the wall, where they are out of the way for loading the truck with forklifts or live skids. These sections are lowered into position as the loading proceeds toward the rear doors. The floor racks which we have developed weigh only 210 pounds for a 35-foot trailer and cost about $200 a set. While we have not yet published the results of this work, a report will be forthcoming soon. Already, however, several manufacturers are making these racks and we are told that several hundred of them have been sold and are now in use.

Improved air circulation results in lower temperatures within the load. Our experiments have disclosed much lower temperatures in the critical hot spots and much greater uniformity in temperatures throughout the load.

Another part of our work is concerned with the study of ways of loading perishable commodities to give maximum protection from impact and vibration in transit. Test shipments were made on various commodities loaded in different ways.

In one type of load, called the end-to-end offset, baskets of peaches throughout the car are loaded on their bottoms. This type of loading means that the baskets are subject to breakage and the contents to bruising when the car gets a severe bump, as cars too often do in rail terminals and classification yards. In 1954, the average claim payment of all railroads for transit damage to peaches was approximately $42.50 per car. A recent regulation of the railroads has required closer tying of the lid at four points around the rim which has cut down the cover bulge materially. This regulation opened the way for experimentation which we have been carrying on with what we call an alternately inverted load, with every other basket upside down. This method permits a more compact load, and the tests we have run so far indicate that damage to the baskets is only half as great as in the upright load.

This past season, with the loss of the peach crop in the South, we ran a series of tests of this load with peaches from western Colorado and with prune-plums from Idaho. The shippers in those areas were very much pleased with the results of the new loading method and also found it easy to load.

Next I am going to talk about cantaloups and watermelons because they are commodities which suffer extremely heavy damage in transit and because we have found out how this damage may be considerably reduced. Cantaloups are shipped in a crate about 13 x 13 x 22 inches. It has quite strong panel ends but narrow and not too strong side slats. For many years shippers have been loading these crates of melons lengthwise of the car. If the car receives even a moderately overspeed impact, the side slats give way, the load shifts, and you have broken crates and bruised melons. In another example of typical damage the crates, instead of pushing upward, jam to the side. The result in either case is the same. Railroad loss and damage claims for cantaloups loaded in this manner average $40 to $45 per car.

Several years ago we began experimenting with loading these crates on-end so that the strong panel ends rather than the side slats would bear the longitudinal shock of impacts in transit. We ran a series of approximately 100 test and check loads comparing the container damage and bruising of melons in unbroken containers over 3 seasons. These studies included 2 types of tests. The first was a pair of cars, one with the containers loaded on-end, the other lengthwise, loaded on the same day at the same shipping point, moved together on the same trains to the same destination in the East. Impact recorders were placed in the cars to measure the intensity of shocks received. In other tests we loaded one-half of the car with all containers on one side of the car on-end, and the other side with containers lengthwise.

The result of all these tests was the same. The average breakage on on-end loads was only one-third as heavy as in the lengthwise loads, and the bruising of melons in unbroken containers was cut by half. One pair of cars tested received unusual heavy rough handling. The impact records showed they had been hit several times at speeds upward of 10 miles per hour. Four miles per hour is considered to be the maximum safe impact in switching and humping cars in yards. In the on-end car of that pair, a number of containers were broken. But what happened to the lengthwise load? It was in shambles.

We published interim reports of the progress of the tests at the end of each season's work, and in the final year many shippers started using the on-end load. Some 1,700 cars were shipped that year. Then the Western shippers started receiving objections from receivers in the East who asked them not to ship them any more loads with the containers on-end. Consequently, except for a few who use the method and have continued to use the method and like it, it has not been generally accepted by the trade up to this time. The railroads have, however, published an amendment to their loading tariff, which was suspended by the Interstate Commerce Commission. Hearings have been held in the suspension case, but a decision is not expected for some time.

Let us now turn to the shipment of watermelons. For as long as melons have been shipped by rail, I suppose they have been loaded the same way--lengthwise of the car. The problem was not too serious with the long-type melons when we had varieties with thicker and tougher rinds. However, within the last 10 years, new varieties such as the Congo and Charleston Grey have been developed by plant breeders of the Department and State Experiment Stations. Both of these varieties are heavy producers and are wonderful eating melons. They have been very popular with both the growers and the consumers. However, these melons have very thin and delicate blossom ends. In some instances the blossom end rind is only 1/8 of an inch thick. Therefore, when the melons are loaded as they now are, lengthwise of the car, with the stem end of one melon resting against the blossom end of the next, many melons are broken and seriously bruised even under normal impacts in transit. We have been informed by the Perishable Inspection Agencies of the eastern railroads that lengthwise loaded cars of these varieties have arrived at destinations in that territory during the past couple of years with an average of 99 melons per car broken or severly bruised. This number is equivalent to about 10 percent of the load, which normally runs around 1,000 melons.

In the summer of 1953 we began a project in cooperation with workers of our Biological Sciences Branch and the State Experiment Stations of Florida, Georgia, and South Carolina. In this project we studied the differences in transit damage that might be obtained by loading the melons crosswise of the car to avoid the end-to-end contact which we felt was doing the damage. The first season we ran a total of 111 test and check cars, and the second season 109. This was the season of 1954.

The results of the 2 years' work showed that the average damage in lengthwise cars in both seasons was 13.4 percent of all melons shipped in the lengthwise loads, while the average damage in the crosswise loads was 4.2 percent, a reduction of about 70 percent.

The results of the tests were published and followed up by a campaign of the railroads to acquaint shippers with the new method of loading, how to load it, and the results that could be obtained. But as in the case of the cantaloups, there was resistance by shippers reflecting the objections of receivers of watermelons at the terminal markets. I have heard of only one crosswise load of melons that was shipped during the summer of 1955.

The resistance of the receivers is based upon the claim that there is greater internal bruising of the melons in a crosswise load.

Shortly after starting the first season's work we became aware of the internal bruising problem through reports of the Experiment Stations which had cooperated by taking a sample of melons from each of the test and check cars at the point of loading. Each of the Experiment Stations reported heavy internal bruising at loading time which indicated that bruising had taken place before the cars were loaded. Being alerted to the problem during the second year's work we cut samples of melons from each of the test and check cars upon arrival at destination to determine the extent of the internal bruising and whether it was any heavier on the crosswise than on the lengthwise loads. We found not only that there was no difference between the two types of loading methods but that there did not seem to be any more internal bruising at destination in either type of load than had been found at point of origin. Consequently, we believe that the internal bruising is a condition related to handling before the car was loaded. We did find a strong relationship of internal bruising to maturity. The bruising was much heavier in the riper melons.

The railroads, having failed to convince the shippers that this was a good loading method to use, have now announced their intention of making it mandatory next season, by publishing a rule in their loading tariffs requiring that long-type melons be loaded crosswise of the car. Receiver and shipper groups have protested and the subject now remains for the decision of the railroad officials. If publication of the mandatory rule is made, the receiver and shipper interests may, of course, seek suspension before the Interstate Commerce Commission.

Some may say "Why concern ourselves about a problem like this? The railroads pay the receivers' claims for loss and damage." All right, let us look at that argument. First, it cannot be denied that these losses represent an uneconomic

waste of good food, into the production and marketing of which has gone a great deal of labor and expense. Second, where do the railroads get the money with which to pay these claims? Why, from the shipper, of course. The cost of claims is reflected in the level of freight rates they charge to haul cantaloups and watermelons to market.

It seems to me some missionary work is needed in which State service people can take an active part.

RECOMMENDATIONS OF WORK GROUP

Mancil Vinson, Kentucky, Chairman
Howard P. Brossett, Louisiana, Secretary

The cost of transporting farm commodities adds up to about 3 billion dollars per year. In the transportation of agricultural perishables, we do not know the extent of the bill for losses of commodities through mechanical breakdown of transportation equipment or deterioration from improper temperatures or other causes, but it is probably more than 100 million dollars annually. Research by Federal and State agencies is developing new methods to reduce transportation costs and to reduce loss of foods on their way to market.

The committee on improving the transportation of farm products, realizing that effective programs by other agencies are already in progress, suggested the following marketing service activities to broaden the effort to translate research results into practice:

1. Many States do not have an organized program for handling such problems. The results gained by those States that do have these projects in effect demonstrate that effective work can be done. The committee urges State Departments of Agriculture to consider seriously setting up specific service programs for improving the transportation of farm products.

2. One of the problems is to overcome the resistance of shippers and receivers in terminal markets to accepting proved research results. The State Departments of Agriculture can be particularly effective by acquainting shippers and producers with the advantages of adopting improved practices. To gather the facts necessary to convince these people of the importance of using such practices, it is suggested that State Departments cooperate on providing one another with materials, such as pictures and reports, on the condition of produce arriving at the receiving point.

IMPROVING WHOLESALING AND RETAILING

Raymond W. Hoecker,
Transportation and Facilities Branch,
Marketing Research Division,
Agricultural Marketing Service, U.S.D.A.

Improvements in wholesaling and retailing are important not only to food distributors but also to consumers and farmers. Notwithstanding the substantial improvements made in food wholesaling and retailing during recent years, the performance of these functions accounts for over half the total costs of marketing farm products.

Retailing is particularly important from another viewpoint, since it is in the retail store that the consumer decides whether to take a product or leave it.

Most of the Department's research and educational programs directed to improving the wholesaling and retailing of food are new compared with some of the service programs such as market news and grading and inspection. Consequently, they are less well-known among those engaged in food distribution.

Most of the Department's research at the retail level aims at increasing the efficiency of food distribution through developing improved handling and operational practices. Additional research has been done on merchandising, management, and personnel problems, but these studies have been largely of an exploratory nature in a relatively new area of research.

Much of the research has been conducted in supermarket outlets of corporate chains. This type of outlet has advantages in developing results with a minimum expenditure of resources, which results are applicable to other types of outlets. Improved work methods, materials, equipment, workplace arrangements, layout, and operational practices have been developed for the grocery, meat, frozen food, and produce departments as well as the check-out operation. Some research has been carried on through service wholesalers with the objective of helping independent retailers utilize their selling space to best advantage. The results have been made available to the industry through such media as Government publications, trade magazines, public patents, educational agencies, and speeches. As resources become available, it is planned to direct more research to working directly with the smaller operators as well as to continue work on the many problems confronting supermarket operators.

Physical Handling and Facilities

Wholesale and retail distribution of farm and food products involve the physical handling of millions of tons of merchandise each year. Wholesalers unload products from carriers; move them into, within, and out of their warehouses; load them on trucks; and unload them at the retail stores, restaurants, or institutions. Retailers move the merchandise into the back room; price mark it and, in case of perishables, recondition it and package it; move it to display

shelves and cases; after the customer makes her selection, package and check it out; and finally put it in the customer's car.

Physical handling involves 75 to 85 percent of the labor required for food distribution. Moreover, rough and excessive handling results in losses to marketing agencies through spoilage and waste that aggregate millions of dollars annually.

The overall objective of the research on physical handling and facilities is to use the resources more efficiently and to reduce spoilage and waste. The research is directed to problems of a functional character. Techniques of economic analysis and industrial management are combined to obtain increased efficiency in the distributive channels.

Surveys are made of the food industry to determine current handling and operating practices and to discover those firms that appear to have the best practices for the function and department being studied. Then detailed economic and engineering type analyses are made of those practices that appear to be performed most efficiently in firms with differing volumes, equipment, methods, and location characteristics. After the typical methods of performing the operation are studied, new and usually improved work methods, equipment, layout, materials, and operational practices are developed and tested under operating conditions. All of the research is conducted in close cooperation with the distributive industry and all of the basic data are obtained directly from operating results of the firms studied.

New facilities for food distribution usually are planned to make possible savings in handling costs and reduction of waste. The Department develops improved designs for the facilities and cooperates with industry in getting the facilities constructed. In some instances this involves the detailed analysis and planning of a complete food distribution center, as in the case of Philadelphia, and in others the planning of individual retail stores and wholesale houses. The Department has furnished plans for the construction of most of the wholesale produce markets recently constructed.

Personnel Management

The research initiated by the Department on personnel management grew out of the research on improved handling and operating practices; it has been abundantly demonstrated that the development of these improved practices is worth little unless the firms' operating personnel will use them. Research concerned with improving personnel management has been effectively used by many manufacturers and other firms. Increased productivity has been obtained and resistance to new procedures has been reduced through better organization and coordination of work groups, improved methods of introducing new operating procedures, and better training techniques. However, there has been little application of these experiences to the food distribution industry. The development of the Department's research has aided in demonstrating that better personnel management practices can contribute to increased productivity in food distribution as tangibly and directly as improved handling facilities and equipment.

The objective of this general area of research is to help obtain the full potential value of sound operating procedures and improved handling methods by better personnel management practices, thus holding down the cost of distributing food. The research is designed in part to develop and test techniques of training and retraining which can be applied by operators to reduce resistance to and win more enthusiasm for improved procedures and equipment. Other research is directed toward improving managerial skills and increasing the effectiveness of communication between the store manager and his wholesale suppliers or central chainstore organization so that managers may learn and use improved distribution methods with a minimum amount of delay.

Market Development and Merchandising

The development of new products and the improvement of existing products are key factors in maintaining present markets and developing new ones. The primary purposes of work in this area are to determine: (1) Market potentials for various agricultural products; (2) economic aspects of expanded or alternative outlets for new or established agricultural products; (3) economic feasibility of byproduct utilization; and (4) development of merchandising practices which will result in larger sales to consumers.

Research during the recent past has been directed toward appraisal of new product potentials and a study of potential markets for other commodities which are in surplus supply. Illustrative of the research in this area is that of testing and evaluating the possibilities of expanding outlets for frozen grapefruit sections. Another study dealt with the effects of changes in consumption, prices, and merchandising methods for milk on net returns to producers and distributors in Memphis, Tenn.

Merchandising research currently underway in the Department is designed to test and evaluate the effect of the use of selected retail merchandising practices--packaging and package sizes; type, size, and location of displays; pricing differentials; and methods of pricing and promotion--upon sales of and consumer demand for selected commodities. Alternative methods of merchandising a product are being evaluated by measuring comparative consumer purchases, using applications of the rotational-type experimental designs to eliminate time and store differences.

Illustrative of the merchandising work being done is that for apples. This commodity was displayed in combinations of bulk and polyethylene bags (plain and printed) with variations in bag weights and pricing units offered customers. Similar research on alternative methods of merchandising are currently being tested and measured in a series of controlled experiments for potatoes, pears, pork chops, red sour cherries, and carrots.

Wholesaling

Research focused on problems at the wholesale level has emphasized developing methods of increasing the efficiency of independently operated produce and grocery wholesale firms. Materials-handling research now underway with

wholesale produce distributors has as its objectives the evaluation of currently used handling methods and equipment and the development of improved methods and equipment. Emphasis has also been given to designing improved wholesale produce market facilities. Research with grocery wholesale firms has been primarily directed to improving the work methods and equipment of warehouses and, to a limited extent, toward more efficient delivery, selling, and administrative practices. Many other problems of these wholesalers, as well as other types of wholesalers and chainstore operations, remain to be studied.

The proper integration of wholesaling and retailing functions, as shown by chainstore operations, can make possible substantial economies in food distribution. Many independent food wholesalers serving independent retailers have launched, or are considering launching, broad programs to assist their retailers in becoming more efficient and effective operators and to help the wholesaler reduce his costs. Research in this area is designed to develop effective integration practices primarily for the independent wholesalers and retailers, but also for the chain operators where feasible. Research has been focused on the service programs of grocer wholesalers to determine what practices appear to be effective, how they are being used, and what new practices should be followed. Service wholesalers of other types--including dealers in fresh fruits and vegetables, meats, poultry, and the institutional suppliers--have similar problems of coordinating their wholesaling function with the retailing function.

Selected Wholesaling and Retailing Reports

A selected group of reports are listed, with a short summary of the results, in order to illustrate the type of research results that have been obtained and which are available in report form. A complete list may be obtained from the Agricultural Marketing Service of the U. S. Department of Agriculture.

1. Some Improved Methods of Handling Groceries in Self-Service Retail Food Stores. By E. M. Harwell and Paul F. Shaffer, Marketing Research Report No. 7. May 1952.

   The use of proper methods, equipment, and layout in receiving, checking in, price marking, and stocking groceries in the retail food stores studied increased productivity in these operations from 67 to 87 percent.

2. The Check-Out Operation in Self-Service Retail Food Stores. By E. M. Harwell and Paul F. Shaffer, Agriculture Information Bulletin No. 31. Jan. 1951.

   The improved type check-out counter which was developed increased by 38 percent the number of orders checked out per hour as compared with the conventional methods then in use. Cost per order decreased by 26 percent.

3. Receiving, Blocking, and Cutting Meats in Retail Food Stores. By E. M. Harwell, Dale L. Anderson, Paul F. Shaffer, and Robert H. Knowles. Marketing Research Report No. 41. June 1953.

Packaging and Displaying Meats in Self-Service Meat Markets. By E. M. Harwell, Dale L. Anderson, Paul F. Shaffer, and Robert Knowles. Marketing Research Report No. 44. June 1953.

Principles of Layout for Self-Service Meat Departments. By Dale L. Anderson and Paul F. Shaffer. Marketing Research Report No. 77. Nov. 1954.

Productivity measured in sales per man-hour increased approximately one-fourth in 7 self-service meat departments when these departments were remodeled according to the principles developed and with use of certain improved methods, materials, and equipment. Improvements in equipment, work methods, and workplace arrangements were developed for the receiving, blocking, cutting, packaging, price marking, and display operations.

4. How Some Wholesale Grocers Build Better Retailers. By John H. Davenport and R. W. Hoecker. Marketing Research Report No. 12. May 1952.

Methods of Handling and Delivering Orders Used by Some Leading Wholesale Grocers. By Martin Kriesberg. Marketing Research Report No. 13. May 1952.

View of Independent Grocers on Wholesaler-Retailer Relations. By John C. Bouma and Martin Kriesberg. Marketing Research Report No. 42. June 1953.

The objectives of these reports are to develop ways to hold down the costs of distributing food through proper cooperation among wholesalers and retailers. The reports set forth some of the services rendered retailers by successful wholesalers for their mutual benefit, how these services can be improved, and how retailers evaluate the services.

5. Improving the Performance of Retail Food Store Cashiers Through Better Training. By Martin Kriesberg. Marketing Research Report No. 48. June 1953.

Improving the Efficiency of Retail Grocery Clerks by Better Training. By Martin Kriesberg. Marketing Research Report No. 82. March 1955.

These reports are concerned with the development and evaluation of improving the efficiency and productivity of retail store cashiers and grocery clerks through better techniques of personnel management. Performance was improved considerably by carefully planned instruction in which there was emphasis on employee participation. Such methods produced superior performance in adopting new practices, adherence to established procedures, courtesy to customers, and utilization of working time.

6. Methods of Increasing Productivity in Modern Grocery Warehouses. By John C. Bouma. Marketing Research Report No. 94. June 1955.

The number of man-hours required in the warehousing operation was reduced an average of 13 percent in 6 modern one-floor wholesale grocery warehouses studied through improved work methods, better utilization of equipment, and balanced work crews. Projected man-hour savings of an additional 8 percent, for a total of 21 percent, can be expected after new equipment is installed and in operation.

7. Better Utilization of Selling Space in Food Stores. - Part I Relation of Size of Shelf Display to Sales of Canned Fruits and Vegetables. By Hans Pauli and R. W. Hoecker. Marketing Research Report No. 30. Nov. 1952.

Space Allocation for Grocery Items in Food Stores. By V. L. Browner and Hans Pauli. Marketing Research Report No. 80. Feb. 1955.

Effective utilization of the selling space in retail food stores helps reduce the cost of retailing. A study of the sales and inventories of 11 retail food stores revealed that approximately 30 percent of the grocery items studied had average sales of one unit per week or less.

8. Improved Handling of Frozen Foods in Retail Stores. By Dale L. Anderson and Paul F. Shaffer. Marketing Research Report No. 104. Sept. 1955.

Improved methods of receiving, price marking, and displaying frozen food, as well as improved equipment, resulted in labor productivity increases of 31, 36, and 44 percent over conventional methods and equipment in 3 supermarkets. With improved methods the total labor requirements were 3.0 to 3.7 minutes per carton handled.

RECOMMENDATIONS OF WORK GROUP

Donald Wilkinson, Wisconsin, Chairman
Taylor Grizzard, Virginia, Secretary

Current trends in food marketing and merchandising are toward larger facilities at both the wholesale and retail levels. These changes bring about the need for more efficient operation and the adoption of improved techniques and handling methods if the separate units are to prosper and the industry continue to grow.

The Agricultural Marketing Service of the U. S. Department of Agriculture has recently completed useful research projects in the more important phases of wholesaling and retailing. The following areas are those in which the greatest amount of research findings have been reported: (1) Physical handling and facilities, (2) personnel management, (3) market development and merchandising, and (4) wholesaling.

The important area of endeavor now seems to make a practical application of the above-mentioned research findings in order that the industry might benefit from available findings as further research continues. Responsibility for performing this work should be assumed by both the State Departments of Agriculture and the Extension Service. Division of responsibility in the various areas of this work should be handled at the local level.

The work group on improving wholesaling and retailing made the following conclusions:

1. Improving wholesaling and retailing merits the attention of State Departments of Agriculture marketing service personnel.

2. State Departments of Agriculture should become better informed as to research findings in this field.

3. State Departments of Agriculture should take the initiative in developing a service program in this field.

CONCLUDING REMARKS

William C. Crow, Liaison Officer,
State Departments of Agriculture,
Agricultural Marketing Service, U.S.D.A.

The attendance at this workshop is the largest we have had at any marketing service workshop. It is truly gratifying to those who have had anything to do with setting up the program or making the arrangements for the workshop to see such a large group taking an enthusiastic part in the various meetings.

Many people are responsible for the success of this conference, and I would like to thank them on behalf of each one here for doing a good job with such a tremendous undertaking. First of all, our gratitude is extended to the staff at Purdue University for making available to us the facilities of their fine institution and for their sincere hospitality, which makes us all feel that we want to come again. We are deeply indebted to the speakers for their enlightening presentations on research already completed or being done in their respective fields, and to the chairmen and secretaries of the various work groups for keeping us on the tract and for extracting and briefing our ideas on the problems under consideration.

To the Commissioners, Secretaries, and Directors of Agriculture, who presided over our general meetings and who made many valuable contributions to our workshop, we are deeply grateful. I want to express my personal appreciation to my colleagues in the U. S. Department of Agriculture, who explained to us how certain programs work and who presented practical research findings under some of the projects being carried on there. We would like to congratulate the program committee for doing an excellent job of planning, casting, and directing the workshop. To each individual who has made a contribution in any way, we extend our appreciation.

We hope our efforts here will have far-reaching effects. The workshop has given us an exceedingly good opportunity to exchange ideas and to find out what the people in other States are doing to solve problems similar to the ones that each of us encounters in the performance of his work. By so doing, we are one step closer to the primary goal of the workshop--that is, to develop a better program in your State and in others. Therefore, whether or not it has been a worthwhile task depends upon each of you--upon what you do with the results when you return to your job.

Let others in your State and in your agency benefit from your experiences here, and apply the new ideas wherever possible to make your program a better program. We hope that as a result of this workshop research and service people will work more closely together, and that you have a better view of your individual problems and how to handle them. So let us not fail in the task that is now ahead of us. Take back to your State the results of the workshop, and may you have a safe trip home.

PERSONS ATTENDING THE WORKSHOP

Aull, George H.	Clemson College	Clemson, S. C.
Bain, Patterson	Mo. Dept. of Agriculture	Jefferson City, Mo.
Ballentine, L. Y.	N. C. Dept. of Agriculture	Raleigh, N. C.
Blomeley, Carl L.	Ky. Dept. of Agriculture	Frankfort, Ky.
Bodin, Roy A.	Minn. Crop Reporting Service	St. Paul, Minn.
Brady, D. E.	University of Missouri	Columbia, Mo.
Bridges, Leroy	Okla. State Board of Agriculture	Oklahoma City, Okla.
Brosset, Howard P.	La. Dept. of Agriculture and Immigration	Baton Rouge, La.
Brundage, Roy C.	Purdue University	Lafayette, Ind.
Brunk, Max E.	Cornell University	Ithaca, N. Y.
Buell, Noble E.	U. S. Fish and Wild Life Service	Mitchell, S. Dak.
Burkholder, Charles A.	Purdue University	Lafayette, Ind.
Burr, D. D.	Mo. Dept. of Agriculture	Jefferson City, Mo.
Campbell, Charles E.	W. Va. Dept. of Agriculture	Charleston, W. Va.
Carey, C. J.	Calif. Dept. of Agriculture	Sacramento, Calif.
Chapman, Clyde M.	Purdue University	Lafayette, Ind.
Charron, William P.	Maine Dept. of Agriculture	Augusta, Maine
Chick, George H.	Maine Dept. of Agriculture	Augusta, Maine
Collins, Edward C.	A.M.S., U.S.D.A.	Washington, D. C.
Cook, Harold T.	A.M.S., U.S.D.A.	Beltsville, Md.
Cox, Clifton B.	Purdue University	Lafayette, Ind.
Crow, William C.	A.M.S., U.S.D.A.	Washington, D. C.
Dachtler, William C.	A.M.S., U.S.D.A.	Washington, D. C.
Dahl, Math	N. Dak. Dept. of Agriculture and Labor	Bismarck, N. Dak.
Davis, Lyle L.	A.M.S., U.S.D.A.	Beltsville, Md.
DeCuir, Walter J.	La. Dept. of Agriculture and Immigration	Baton Rouge, La.
Driggs, Leslie W.	N. Y. Dept. of Agriculture and Markets	Albany, N. Y.
Dunn, Lewis F.	N. C. Dept. of Agriculture	Raleigh, N. C.
Dunsdon, Rollin	Purdue University	Lafayette, Ind.
Dyer, Boyce	Ga. Dept. of Agriculture	Atlanta, Ga.

Engendorff, O. H.	Wyo. Dept. of Agriculture	Cheyenne, Wyo.
Ewing, J. A.	Ill. Crop Reporting Board	Springfield, Ill.
Faison, O. W.	N. C. Dept. of Agriculture	Raleigh, N. C.
Faller, Marvin A.	La. Dept. of Agriculture and Immigration	Baton Rouge, La.
Farris, W. K., Jr.	Ala. Dept. of Agriculture and Industries	Montgomery, Ala.
Farris, W. S.	Purdue University	Lafayette, Ind.
Fawcett, K. I.	Purdue University	Lafayette, Ind.
Fenton, Floyd E.	A.M.S., U.S.D.A.	Washington, D. C.
Fink, Oliver F.	Mo. Dept. of Agriculture	Jefferson City, Mo.
Foreman, Davis	Ill. Dept. of Agriculture	Springfield, Ill.
Foster, L. G.	A.M.S., U.S.D.A.	Washington, D. C.
Fox, R. L.	F.C.S., U.S.D.A.	Washington, D. C.
Fox, Tom	Okla. State Board of Agriculture	Oklahoma City, Okla.
Freeland, Roy	Kans. State Board of Agriculture	Topeka, Kans.
Freeman, G. Chester	A.M.S., U.S.D.A.	Washington, D. C.
French, Charles	Purdue University	Lafayette, Ind.
Frey, Howard G.	Iowa Crop Reporting Service	Des Moines, Iowa
Germany, Ralph	La. Dept. of Agriculture and Immigration	Baton Rouge, La.
Grizzard, Taylor L.	Va. Dept. of Agriculture and Immigration	Richmond, Va.
Gwin, James M.	Poultry and Egg National Board	Chicago, Ill.
Handy, Russell P.	W. Va. Crop Reporting Service	Charleston, W. Va.
Harris, J. R.	Ill. Dept. of Agriculture	Springfield, Ill.
Harvay, Nigel	Purdue University	Lafayette, Ind.
Hasenmyer, Dean	Ill. Crop Reporting Service	Springfield, Ill.
Hawkins, C. R.	W. Va. Dept. of Agriculture	Charleston, W. Va.
Henderson, Roy M.	U. S. Fish and Wild Life Service	Minot, N. Dak.
Henning, George F.	Ohio State University	Columbus, Ohio
Hering, Hunter	Mich. Dept. of Agriculture	Lansing, Mich.
Herrick, Joseph F., Jr.	A.M.S., U.S.D.A.	Washington, D. C.
Herrmann, Omer W.	A.M.S., U.S.D.A.	Washington, D. C.
Hindman, Ruel R.	Ill. Dept. of Agriculture	Springfield, Ill.
Hoecker, Raymond W.	A.M.S., U.S.D.A.	Washington, D. C.
Holloway, John B.	N. Y. Dept. of Agriculture and Markets	Albany, N. Y.
Isaacs, G. W.	Purdue University	Lafayette, Ind.
James, William L.	Va. Dept. of Agriculture and Immigration	Richmond, Va.
Johnson, Roy B.	La. Dept. of Agriculture and Immigration	Baton Rouge, La.

Jones, W. E.	F.E.S., U.S.D.A.	Washington, D. C.
Justin, Miner M.	Purdue University	Lafayette, Ind.
Keener, Byron	Ala. Dept. of Agriculture and Industries	Montgomery, Ala.
Kohls, R. L.	Purdue University	Lafayette, Ind.
Korslund, Harry J.	Purdue University	Lafayette, Ind.
Krause, Orville E.	Wis. Crop Reporting Service	Madison, Wis.
Lee, E. R.	Livestock Sanitary Board	Little Rock, Ark.
MacDonald, David H.	Purdue University	Lafayette, Ind.
Magruder, Roy	A.R.S., U.S.D.A.	Washington, D. C.
Mahoney, John E.	University of Maryland	College Park, Md.
Manhart, V. C.	Purdue University	Lafayette, Ind.
Marlow, D. R.	Purdue University	Lafayette, Ind.
Marston, H. W.	A.R.S., U.S.D.A.	Washington, D. C.
Martin, Hugh B.	N. C. Dept. of Agriculture	Raleigh, N. C.
Mason, Walter S.	N. Y. Dept. of Agriculture and Markets	Albany, N. Y.
McClaugherty, C. P.	Va. Dept. of Agriculture and Immigration	Richmond, Va.
McDowell, D. N.	Wis. Dept. of Agriculture	Madison, Wis.
McLaughlin, J. B.	W. Va. Dept. of Agriculture	Charleston, W. Va.
Meyer, Amos R.	University of Maryland	College Park, Md.
Miller, Burton R.	Ill. Crop Reporting Service	Springfield, Ill.
Miller, Karl D.	Ohio Dept. of Agriculture	Columbus, Ohio
Moffett, A. G.	Va. Dept. of Agriculture and Immigration	Richmond, Va.
Moser, Charles O.	Colo. Dept. of Agriculture	Denver, Colo.
Murphy, William J.	N. Dak. Dept. of Agriculture and Labor	Bismarck, N. Dak.
Neilson, Donald H.	N. Y. Dept. of Agriculture and Markets	Albany, N. Y.
Nelson, Miles A.	Mich. Dept. of Agriculture	Lansing, Mich.
Norman, Ray	A.M.S., U.S.D.A.	Lansing, Mich.
Oesterle, Eric C.	Purdue University	Lafayette, Ind.
Ott, Leland E.	Purdue University	Lafayette, Ind.
Painter, Stanley L.	Maine Dept. of Agriculture	Augusta, Maine
Park, R. J.	Tenn. Dept. of Agriculture	Nashville, Tenn.
Petr, Winzer	Kans. State Board of Agriculture	Topeka, Kans.
Phillips, C. D.	University of Kentucky	Lexington, Ky.
Quessenberry, H. D.	N. C. Dept. of Agriculture	Raleigh, N. C.
Randell, C. G.	F.C.S., U.S.D.A.	Washington, D. C.

Ray, Harold A.	Kans. State Board of Agriculture	Topeka, Kans.
Ray, Oakley	Purdue University	Lafayette, Ind.
Riley, Harold M.	Michigan State University	East Lansing, Mich.
Robert, Shelby A., Jr.	American Dairy Association	Chicago, Ill.
Robinson, Larry	Okla. State Board of Agriculture	Oklahoma City, Okla.
Scanlan, John J.	F.C.S., U.S.D.A.	Washington, D. C.
Schmidt, Franz	Purdue University	Lafayette, Ind.
Scoles, Roy	Iowa Dept. of Agriculture	Des Moines, Iowa
Scott, Leon	Miss. Dept. of Agriculture and Commerce	Jackson, Miss.
Scott, Raymond C.	F.E.S., U.S.D.A.	Washington, D. C.
Shannon, W. G.	Purdue University	Lafayette, Ind.
Singleton, Rollo E.	Mo. Dept. of Agriculture	Jefferson City, Mo.
Slamp, Kenneth R.	Pa. Dept. of Agriculture	Harrisburg, Pa.
Smith, R. K.	A.M.S., U.S.D.A.	Washington, D. C.
Steiger, Samuel C.	Ohio Dept. of Agriculture	Columbus, Ohio
Stevens, Ira M.	F.C.S., U.S.D.A.	Washington, D. C.
Stokes, Donald R.	A.M.S., U.S.D.A.	Washington, D. C.
Straszheim, Robert E.	Purdue University	Lafayette, Ind.
Stringfield, Ray M.	La. Dept. of Agriculture and Immigration	Baton Rouge, La.
Ubel, Jake R.	Kans. State Board of Agriculture	Topeka, Kans.
Underwood, C. R.	W. Va. Dept. of Agriculture	Charleston, W. Va.
Van Patten, Loyd	Iowa Dept. of Agriculture	Des Moines, Iowa
Vinson, M. J.	Ky. Dept. of Agriculture	Frankfort, Ky.
Wakefield, Olaf	N. C. Crop Reporting Service	Raleigh, N. C.
Watkins, Roy L.	Iowa Dept. of Agriculture	Des Moines, Iowa
Weavers, Harvey J.	Wis. Dept. of Agriculture	Madison, Wis.
Wells, Joe E.	Mich. Dept. of Agriculture	Lansing, Mich.
Wessells, John H.	Va. Dept. of Agriculture and Immigration	Richmond, Va.
White, J. C.	Cornell University	Ithaca, N. Y.
Wiley, James R.	Purdue University	Lafayette, Ind.
Wilkinson, Donald E.	Wis. Dept. of Agriculture	Madison, Wis.
Wilson, R. B.	Purdue University	Lafayette, Ind.
Windisch, Wesley W.	Ohio Dept. of Agriculture	Columbus, Ohio
Winfield, John A.	N. C. Dept. of Agriculture	Raleigh, N. C.
Winter, John C.	A.M.S., U.S.D.A.	Washington, D. C.
Worcester, Mark D.	U. S. Fish and Wild Life Service	Bismarck, N. Dak.
Wurster, Tom	Purdue University	Lafayette, Ind.
Zeleny, Lawrence	A.M.S., U.S.D.A.	Beltsville, Md.
Zuelke, Otto J., Jr.	La. Dept. of Agriculture and Immigration	Baton Rouge, La.

☆U. S. GOVERNMENT PRINTING OFFICE: 1956 O - 3898